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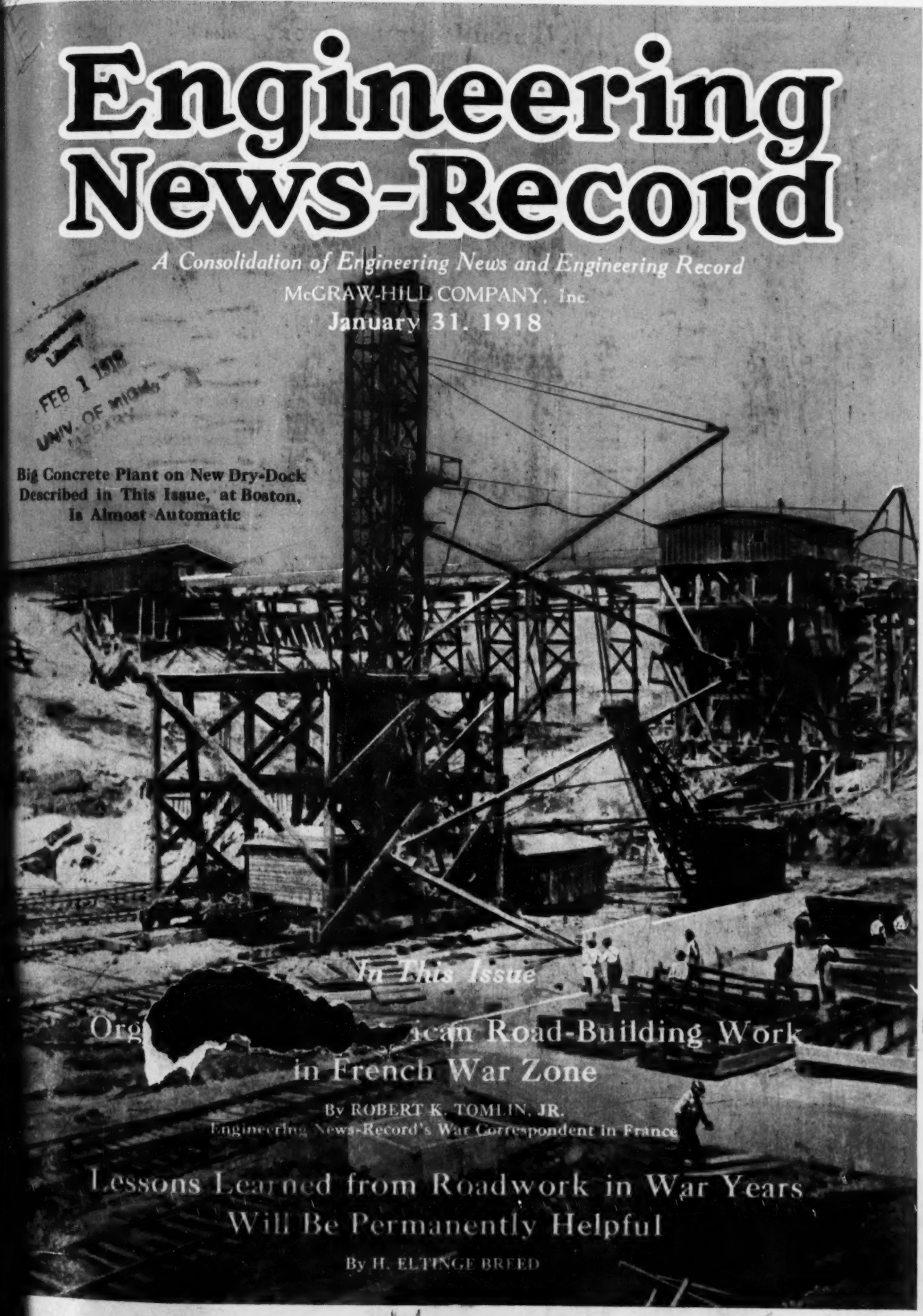

Big Concrete Plant on New Dry-Dock Described in This Issue, at Boston, Is Almost Automatic

In This Issue

Org[illegible]ican Road-Building Work in French War Zone

By ROBERT K. TOMLIN, JR.
Engineering News-Record's War Correspondent in France

Lessons Learned from Roadwork in War Years Will Be Permanently Helpful

By H. ELTINGE BREED

The Daylight Roof

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Note the perfectly diffused top light obtained through the foundry roof of the Great Western Smelting and Refining Company, Chicago, Ill., by the use of Federal Large Glass Tile

Beams of Illumination Are Shot Directly from the Roof to the Working Floor

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is made of Portland Cement, properly reinforced, fully seasoned and stored in our own fireproof, daylight warehouses until shipped to the job ready to be laid in any weather or temperature with none of the dangers and delays of "poured on the job" construction.

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A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. McGRAW, *President*

ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

Volume 80 — NEW YORK, THURSDAY, JANUARY 31, 1918 — Number 5

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Technical Details From France

THE story of organizing highway work for the American forces in France—the first description by a technical correspondent of any of the work of our engineer corps abroad—is found on page 198. Many others are to appear; and while the subject of the present one is not such as to involve many technical details, it is in point to say that in none of Mr. Tomlin's articles can be put all of the detailed information that would be desirable at another time. For example, the amount of traffic to be carried by a highway system, or the number of routes developed to serve a certain number of units would, in the opinion of the authorities, indicate the concentration of troops possible at a given point, or the size of a sector over which an assault could be organized. Bearing this in mind, it will be easy to appreciate, in future articles on engineering activities behind the front, why certain questions that inevitably come to mind must remain, for the present, unanswered.

Give Us the Locomotives!

IN a remarkable interview on Jan. 21 with editors of McGraw-Hill engineering publications, Dr. Garfield completely demonstrated the necessity for the partial suspension of industry that is taking place, and cleared his skirts and those of the Administration of all suspicion of having acted without full knowledge or of having taken the drastic course pursued before exhausting all other possibilities. But with the same words, Dr. Garfield established beyond a doubt the shortsightedness of the Administration after the war was actually upon us in tacitly permitting the Interstate Commerce Commission to block the rate increase which would have enabled the railroads to secure needed money for motive power. For it is engines that we lacked, and still lack; and nothing has been done, even yet, so far as can be seen, to supply the deficiency. Dr. Garfield's figures show that hundreds of engines which should have been scrapped before the war are blocking the shops of the Eastern railroads while miles of empty cars stand idle on the lines for lack of motive power. Yet even as late as last October not one step had been taken to help matters, though there were men in Washington in a position to advise the President who could have foretold our present predicament with one eye shut. *In that month one solitary locomotive was ordered for all the hundreds of thousands of miles of railways in this country!* Today, according to Dr. Garfield's figures, we stand 5000 to 10,000 locomotives short of essential needs of our home railroads, and while our government is sending thousands of locomotives abroad there is no indication that it has taken steps to increase the supply at home by one engine. Is the public to be blamed for doubting the efficiency of an administration which permits such oversights as this and as were revealed before the senate committee on military affairs? Is it not proper that the people should know forthwith what Director-General McAdoo is doing to meet this situation?

Engineers Best Qualified to Judge

MORE disputed valuation questions than can be cited here are discussed in a decision of the Pennsylvania Superior Court, extracts from which appear on page 216 of this issue. The decision is notable both for the court's liberality in the matter of the so-called intangibles, and for the clear exposition of the reasons therefor. One of the interesting phases is the attitude on interest during construction. For reasons not set forth in the decision, the Pennsylvania Public Service Commission had cut down the estimated construction period agreed upon by the opposing engineers. The court, however, concluded that the engineers could compute the time allowance better than lawyers could divine it. To lawyer-commissioners this may seem a violation of vested rights; to engineers it is encouraging.

Road Construction Placed in a New Light

NOW that Washington is committed to an intelligent road construction program, it is calming and heartening to realize that Canada has come to the identical conclusion after three years and more of war. England likewise has decided that the highway network is as essential a part of her war-making resources as many an item over which her successive ministries have split and fallen. To engineers who have been engaged in this work, as well as to the more numerous groups who have been urging extensive programs for reasons that are not so logical, this almost universal change in viewpoint comes as a complete and welcomed justification for their long continued advocacy. The formation last week of the Highways Industries Association seems to indicate, furthermore, that the business of manufacturing materials and machines for road construction may be put on a different and broader basis, and that an understanding has been reached through which much of the unhappy propaganda and counter propaganda that has prejudiced many people may disappear to the benefit of all concerned.

Why Not Fireproof Base Hospitals?

WHEN the cantonments were undertaken, such speed was necessary and low cost so desirable, in view of the total prospective expenditures, that wood was chosen as the construction material with but little debate. Now fireproof and semi-fireproof types are being adopted for warehouses and piersheds, but inflammable construction is being used for the new cantonments and base hospitals. Whatever arguments may apply on cantonments, we think it a grave error to build base hospitals of fire-trap construction, particularly when a semi-fireproof type can be built as rapidly as wood and at an increased cost of only 10 or 15%.

At cantonments there are a great many men available for fire fighting and for fire-patrol duty. Moreover, they are able bodied. The hospitals are to be filled with men largely unable to help themselves. Medical and nursing staffs are hardly large enough to remove many patients in the time likely to be necessary with the inflammable cantonment type of building. Further, the fire hazard in hospitals where buildings are connected by wooden runways (for the transfer of patients) is inexcusable.

Adequate provision against fire is being made for warehouses and piersheds; why not an additional expenditure of 10 or 15% to protect our men? If stucco and hollow tile, brick and concrete are required for the safety of goods, why not for that of human beings?

The cantonment division has shown itself open-minded in the selection of semi-fireproof and fireproof types for certain purposes. With concentration on this problem and a free hand, we are sure it will elect to use a better construction for hospitals than is now planned. The all-timber type for hospitals is an injustice to those who have once risked their lives and are sent home to recover. It is exposing them to mortal danger a second time.

More Attention in Education to Appraisement of Value and Costs

NATIONAL credit is the result and not the cause of intelligent industrial production; the engineer, not the banker, is the real power behind the throne." That startling sentence expresses the fundamental on which Dr. Mann builds his argument (208) regarding the effect of war on engineering education. His paper divides into two parts: first, an interpretation of present economic conditions; second, the changes in engineering education necessary to meet these conditions. The proposals are in the direction of the "co-operative system" of instruction.

As always with broad interpretations, particularly when unconventional, there will be disagreement with Dr. Mann's views on the significance of present conditions. Developments at Washington tend to support his views. It is the gathering place of those "who can do" in contradistinction to those "who have." As indicated in another discussion on this page, the departments have production and labor divisions which are fast taking over the management of their contractor's enterprises, while the War Credits Board is providing for financial needs. When plant owners become operating superintendents for the government, the engineer, not the banker, is the pivotal factor. What of this new order will remain permanent, time only can tell. When peace comes the cause of the present conditions—tremendous government contracts—will have disappeared. Nevertheless, the engineer's position will have been strengthened by the dominant place he will have held during the interval.

Even those, therefore, who may disagree with Dr. Mann's economic interpretation must grant the validity of his plea for closer coöperation between the schools and industry and for "more attention to the appraisement of values and costs." The country, no less than the profession, will be the gainer.

Create a Competent Commission for Federal Water-Power Control

THE administration Water Power Bill, now before the House of Representatives, is undoubtedly an attempt in good faith to end the long deadlock over water-power legislation and pass a bill which will encourage private capital to undertake the development of water power on rivers and lands which are under Federal control.

The bill provides for complete government control and regulation of each water-power project from its inception. The issue of securities, accounting, character of plant to be installed, service to be rendered and rates to be changed, all are subject to control by a Federal commission plus such control as state public service commissions may exercise. When a licensee's property is valued for rate-making purposes, nothing is to be allowed for good will or going value or for the increase in value of lands or water rights after their purchase.

Under these conditions, everything depends on the manner in which the government regulation is exercised. Given fair and intelligent administration, a water-power company might be secure; but it will have to run the risk that the control exercised by the commission will be at various times more or less arbitrary and that some administration may come into power which will be more inclined to seek popularity by lowering rates to consumers than to administer even-handed justice.

The most beneficial amendment which could be made to the bill would be to create a permanent commission to have charge of water-power development in place of a commission made up of the Secretaries of War, Agriculture and the Interior Department, as now provided. These Cabinet officers have already more duties devolving upon them than they can properly perform. They cannot possibly give more than perfunctory attention to water-power development, which is a task in itself so large that it should command the entire time of three of the ablest men that can be found.

Further than this, with a water-power commission made up of the three Secretaries named, the membership of the commission will be liable to entire change every time a change in administration occurs, to say nothing of changes which will occur in the Cabinet officers named during a Presidental term. These changes may and probably will mean that radical changes in the policy and practice of the commision will be likely to occur every four years. If nothing worse occurs, there is every probability that the commission's work would be subject to serious delay at such times of change. It is

easy to forsee, for example, a water-power company held up in important work, perhaps past a season when the stage of water is such that the work could be done at all, because a new administration had not informed itself sufficiently to act.

At present Congressional investigating committees are revealing to the public how lamentably inefficient has been the conduct of the public's business directly under the authority of Cabinet officers in some of the most important matters relating to the war. It is surely a favorable time, therefore, to urge upon Congress that Federal control of water power be placed in the hands of men who will measure up to the size of the job.

It should be possible to amend the bill to provide for a commission of three appointees with a six-year term of office, the term of one member expiring every two years. That would make any changes in policy due to changes in the personnel of the commission gradual, instead of revolutionary, and would provide two commissioners to carry on the business without interruption while a new appointee was learning his duties.

If in addition Congress should provide that at least one of the members of the commission should be an engineer familiar with the art of power development, there would be a far better prospect that capital would be encouraged to undertake on a large scale the development of projects under the law. There would be a far better prospect, too, that the public interest would be adequately protected. Three broad, far-seeing men provided with the authority given in this bill might accomplish a vast deal in the development of the nation's water-power resources, where the same authority in the hands of three ex-officio Cabinet officers would accomplish very little.

What About the Small Railroads?

IS THE Administration to do nothing with the short railroads? When the President announced, Dec. 26, that the Government would as a war measure take over the railroads, there was no suggestion that he did not mean all of them. And the notices served on the various managers seemed indication enough that all were to be included. Yet it now appears from Director General McAdoo's recent remarks to the Senate committee that some of the small lines, deemed non-essential to war work, are left to their own resources; that the notices actually served on them were departmental errors.

Is this fair to the short lines? Excluded from the general scheme, they can hope for little consideration from the Administration. The Government has undertaken to operate the railroads to meet the war's needs, and by Government decree these short lines have nothing to do with the war's needs. Many of the short lines have always been much at the mercy of the trunk lines which afforded their only connection with the rest of the world; but they usually had something in the way of additional business to offer the trunk lines as an argument for traffic arrangements. Now the Government is not seeking additional business; it is concentrating on war needs, and the small roads may well be apprehensive at being left out of the scheme.

So, too, if the Administration is to pick and choose which railroads it shall operate, may it not with equal reason choose between the different lines of a single railroad system? The trunk line as the public knows it is usually made up of many corporate units built around the main unit. Some of these are owned outright by the main unit, some are under lease, some are held by rather loose agreements. The Division of Valuation of the Interstate Commerce Commission is well aware that it is not always easy to determine whether for valuation purposes a line is or is not part of the main system. Does the Director General of Railroads intend to treat the large railroads as a whole, or will he conclude that loosely owned branch lines that are not needed for war purposes can be left to shift for themselves?

And what after the war? The owners of the large roads have asked the Administration when their property will be returned to them. It is common opinion that it never will be. If so, public sentiment will hardly enthuse over the absorption after the war of odds and ends deemed unnecessary during the war. But surely the Government will not take all of the best and stop there. If the principle of government ownership is ultimately adopted it should be applied impartially to all railroads. And to reassure the public on this point, as well as to save the owners of the small roads from immediate loss, the Director General should assume responsibility now for all of the railroads.

Government Operation of Industries

IN THE earliest war contracts, manufacturers and builders were more or less independent agents. Today the inefficient ones are being reduced to the role of government superintendents. The movement is significant. *Industry*, as well as the railroads, *is coming under complete government control.* For the time it is not clear whether efficient contractors—and the word contractor is here taken in a general sense—will maintain their independence. The really efficient companies, though, are so few that the sweeping statement is warranted.

The first result of federal control will be a new system of letting contracts. If the government assumes all risks, it will pay only a management and a plant rental fee. Private profits will cease. The public, which takes the risks, will take the profits.

The argument will here be applied to the "cost plus profit" form of contract, though it holds equally well for the "fixed-sum" type.

In "cost-plus" contracts, the government necessarily has taken the price risks as to materials and labor. Now the assumption of responsibility is more complete. Originally the government merely paid the bills. Months ago it began insuring the procurement of materials. Now it is beginning to assume responsibility for labor supply. In other words, it is taking *all* labor and materials risks.

It is also attacking management problems. Progress charts are discovering delayed production, and production specialists are being sent to cure the ills disclosed. Labor, as well as materials and equipment problems and inefficiency, comes within their purview. The government is thus assuming the management risk.

Finally, if a contractor is in difficulty financially, if the banks will not carry him longer, the government extends the necessary credit. It is taking the financial risk.

American Road-Building Work in French War Zone Organized

Inspection of British and French Systems by United States Highway Engineer Officers Aids in Development of Methods—Waterbound Macadam the Main Reliance

By ROBERT K. TOMLIN, Jr.
Formerly Managing Editor, and now War Correspondent in France, of "Engineering News-Record"

AMERICAN road construction and maintenance work in that part of France assigned to United States troops has been definitely organized, and I was given an opportunity at the office of the Director General of Transportation, American Expeditionary Force, of learning some of the general features of how the immense task of maintaining our highway lines of communication will be handled. As yet no large-scale field operations have been undertaken by our road-building forces, but the nucleus of American engineer officers, who were sent to France some time ago, and who will become the administrative heads in charge of the several subdivisions of the great project, have been spending their time in inspections of the British and French lines of communication, in conferences with the officers in charge of these operations for our Allies, and in formulating plans for our own work. As a result of this coöperation our road engineers have been able to utilize to great advantage the experiences of the French and British and to blend these with the best American practice in mapping out the work to which they have been assigned.

The Manager of Roads

All road-building and maintenance work in the American territory has been placed under the general control of the Director General of Transportation, who has delegated the responsibility for all highway operations to a Manager of Roads, with an organization of his own. The Manager of Roads is well known professionally, a member of both the American Society of Civil Engineers and the British Institution of Civil Engineers, and recently gave up his consulting practice to become one of the administrative heads of a commission directing municipal subway construction operations involving the expenditure of many millions of dollars. It is not permitted to mention by name the men who are handling the road work. The Manager of Roads will concern himself principally with the executive end of the highway work, while the actual field operations will be in the hands of special road building and quarry regiments, such as those in behalf of which *Engineering News-Record* conducted its recent recruiting campaigns. The relations between the staff of the Road Manager and the technical troops in the field will be somewhat similar to those which ordinarily exist between a State Highway Department and a contractor. The Office of Road Manager, however, will not only designate where work will be done, but will also relieve the field officers of the routine involved in getting shipments of construction plant, materials and supplies to specific places and at specific times. The Road Manager's office will be, in effect, a sort of clearing-house, a place where the efforts of the various construction regiments will be coördinated and rendered of maximum value. It will serve also as a sort of priority board in the distribution of such materials as the output of crushed stone from quarries.

Work Departmentalized

Under the Road Manager will be various department heads. The organization chart, which I was permitted to examine, shows such titles as Deputy Manger of Roads, Road Engineer, Assistant Road Engineer, Superintendent of Supplies, Superintendent of Equipment (who will be a mechanical engineer), Superintendent of Quarries, Engineer of Bridges, and, a very significant title, Superintendent of Business Affairs. There will also be a General Superintendent of Construction and division engineers assigned to prescribed areas occupied by American troops. The organization scheme was developed only after a careful study of the British and French systems.

In making a tour of the office of the Road Manager I saw many familiar faces. There were engineers from State Highway Departments, who know construction methods in detail, men who have seen service in United States Office of Public Roads at Washington, men who have formerly been consulting engineers and city engineers back in the "States"; men who had served on the faculties of our engineering colleges; bridge designers, computers, and so on, right down the line to draftsmen, clerks and stenographers. All, of course, were in uniform, with the castle insignia on collar band denoting the Corps of Engineers. It is no inexperienced corps of road builders who form this staff of the Manager of Roads. Each is a specialist in his line, with years of practical training back of him, and when I left the building I carried away the impression that our highway work is in the hands of men eminently qualified for the work to be done—men who have given up positions of great responsibility back home to place at the disposal of the Government their specialized knowledge of engineering administration and of the various branches of road construction and maintenance.

So much for the general scheme of organization—and it must be stated in general terms only, for these are not times when it is desirable to be specific. The road building and quarry regiments from the States will reach the scene of action completely equipped with the construction plant necessary to the efficient conduct of their operations in the field. Much of the French work, I learn, has been done by hand. For example, a French officer told me yesterday that the bulk of the stone he

used for road maintenance work was quarried and crushed by hand. With mechanical crushers the American forces will be able to effect a great increase in output of crushed stone from quarries. And on this subject of crushers an interesting point developed. It appears that the prevalent rock for road building in France is a very soft limestone, so soft, in fact, that it is apt to clog a crusher of the gyratory type. For this material, therefore, a jaw-crusher rather than a gyratory crusher would seem to be best adapted.

British and French Methods

I have said before that the American road engineers have been making frequent trips back of the British and French lines. They told me some of the results of their observations. The waterbound macadam road is in almost universal use, although, I believe, the British have a small mileage of tarred surface. From what I can learn the caption "Macadam Roads Best for War Traffic," which appeared over the editorial in *Engineering News-Record* of Sept. 13, 1917, and to which exception was taken in a number of letters to the editor, needs no revision. A tour of the front, I have heard, alters many preconceived opinions as to types of road construction adapted to conditions of actual warfare. In any event I have not been able to verify any reports as to the extensive use of any of the so-called "permanent" types of road surface by the Allied forces. It is possible, I understand, that some form of surface other than straight waterbound macadam may be used far back from the front line trenches, but macadam seems to be the main reliance in any territory where operations are at all active.

American highway engineers seem to be greatly pleased with the properties of the French limestone as a material for *speedy* road construction. It is very soft, and compacts quite readily under a road roller, and is the chief reliance as a road-building material, although it requires constant maintenance. A limited amount of trap-rock is available and a French engineer, now returned from active service, told me on his section of road work he employed slag successfully. The roads where the slag was used, however, were near industrial centers where supplies of this material could be secured without the necessity of a long haul. One objection to the waterbound macadam road, I find, is the dust which rises from it under traffic during dry periods in summer. Some use of oil as a binder and dust palliative may be tried, but I hear that it is next to impossible to secure any quantity of bituminous material for road work in France today. In certain of the towns near the front there are large signs along the roadside cautioning the drivers of motor trucks, or camions as they call them here, to drive slowly. Fast driving, with its attendant dust clouds, is apt to draw artillery fire on the roads.

Maintenance the Chief Problem

The chief problems of the American road-builders over here will relate to maintenance, as the mileage of existing French roads is very great; one estimate placed it at 1 mile of road to every 1½ sq.mi. of ground surface. New construction will take the form of widening roads already built. While the French national roads have ample widths, some of the secondary routes having widths of 18 ft. must be widened to about 34 ft. These roads generally have extensive berms so that the widening operation merely entails the placing of road metal on both sides for the extra width desired without disturbing the existing drainage ditches or interrupting traffic. Where new roads must be built observers state that the French lay the bottom course of one-man stone by hand, while it is common in British military practice merely to dump the stone for the bottom course directly upon the subgrade without any very refined attempt in the placing of the stones. On this base course, 10 or 12 in. in thickness, is spread a layer of 2½-in. stone and on top screenings are placed and rolled. The English have used tarring to a limited extent, generally in the vicinity of hospitals.

Military roads of course are subjected to unusually severe loadings and the "tank," with its cleated caterpillar traction bands—a load of perhaps 30 tons on a 4-ft. wheel base—is a disturbing factor to the officer in charge of road-maintenance. Artillery loads of 18 tons on one axle, I am told, are not unusual. As for the tank, I understand that it is kept off the roads wherever possible; if it must take to the right of way a road-maintenance crew follows in its wake. The tank also has given the bridge builders something to worry about.

Plank Roads Near Front

Where highways must be advanced close to the front lines the construction type takes the form of plank road. In this territory the ground may be merely a succession of shell craters, so irregular in surface contour as to preclude any of the ordinary types of construction without elaborate grading operations. In this work plank of a standard length and cross-sectional area, 5 x 9 in. by 9 ft. is employed. Three of these plank are laid parallel to the longitudinal axis of the road, like bridge stringers, and the surface timbers are laid transversely on the stringers, to which they are spiked. At each side longitudinal guard timbers are spiked and the surface is built with a pitch of 3 in. toward one side to shed water. This plank construction generally is only wide enough for one-way traffic.

American officers are enthusiastic over the excellent system of traffic regulation on military roads used by the English. At specified points military "traffic cops" are stationed and are provided with red, green and white signals—flags by day and small lamps by night. A red signal brings traffic to a stop, green slows it down, while white means "all clear." When large stores of munitions and supplies are in transit the traffic is said to compare in density to that on Fifth Avenue, New York, while the actual tonnage, of course, is much greater.

It may happen that a brigade of artillery, stationed in fields alongside the road, is suddenly called into action. The road police stop all motor-truck traffic instantly, get the right-of-way clear so that the artillery may reach its position without delay. Another feature of the road work is the prevalence of the large signboards indicating the way to different towns.

At night, of course, it is dangerous for vehicles to show lights, and to aid the driver in keeping on the right-of-way wooden pickets, whitewashed, are driven along the outer edges of the roads at about 10-ft. in-

tervals. I was talking last night to an American ambulance driver who had seen service in the Verdun sector, and he told me that it was a favorite stunt of the Boche airmen to fly low over the road at night when supplies were being brought up and rake the center line with machine guns in an effort to "get" the drivers of the camions.

On the question of plant for road building, the American engineer officers with whom I spoke pointed out the danger of a steam-roller near the front. Puffs of smoke or exhaust steam disclose the position of work to the enemy. Gasoline-driven machines are preferred on account of what I suppose a naval man would call their "low visibility," although the steam outfits are useful further back. The exhaust steam and smoke from a road roller makes a fine target for shells or bombs, and much of the road work must be done in the danger zone. In regard to gasoline machines, the single-cylinder type is not regarded with favor, preference being given to the two-cylinder machine as more dependable. If the engine stalls it is generally a long way back home.

Narrow-gage track is a big factor in the transportation problem and I hope in later reports to give some of the details as to laying and handling of these units. Standard-gage railroad track, narrow-gage industrial track, and waterbound macadam highway for motor-truck traffic form the great triumvirate of transportation used in France today. It is significant in the scheme of organization behind the fighting front that the control of all of these aids to the movement of supplies, munitions and men, is centralized in one department, that of Director General of Transportation.

Concrete Plant on Boston Dry Dock Almost Automatic

Heavy Rock Excavation Under Way with Well Drills and Railroad Shovels—55-Foot Rise to Dump Curtails Output—Six-Inch Pump Handles Leakage Under 60-Foot Head

By Edmund M. Blake

Formerly Engineer, Holbrook, Cabot & Rollins Corporation, New Dry Dock, Boston, Mass.

An electrically-operated, belt-fed concrete plant of 100 yd. an hour capacity in which hands convey none of the material from the time of its receipt until it is deposited as mixed concrete in the form is in use on the dry dock being built for the Commonwealth of Massachusetts at Boston by the Holbrook, Cabot & Rollins Corporation. The plant is supplied even to the cement by belt conveyors, and concrete is transported by rail and placed through chutes by a hoisting tower traveling down the center of the dock.

The site of the dock was dredged free of all but about 60,000 yd. of earth excavation, which consisted of clay and hardpan, some 630,000 yd. of which was taken out and dumped at sea before closing the cofferdam. The remaining earth and about 90,000 yd. of slate rock above subgrade are being removed principally by two large steam shovels, the drilling of the rock being done by well drills. The output of the shovels is limited by the long switchback haul required to climb 55 ft. out of the hole to the dumping level. Although some difficulty was experienced with a section of the first closure cofferdam, all movement ceased after the break was stopped with a new section of cofferdam and a large tonnage of riprap, and the 14-acre hole is one of the driest deep coffers ever pumped. During high tide without rain, one 6-in. centrifugal pump discharging 1100 gal. per min. against a 54-ft. head balances the leakage.

The dry dock, 1200 ft. in length over all and 150 ft. in width at the top, was designed to take 1000-ft. vessels, and will accommodate the largest naval or merchant ships afloat. One of the most interesting features of the design, which was briefly outlined on page 740 of the *Engineering Record* for Dec. 11, 1915, is the plan of stopping the excavation for a great part of the width of the dock walls as soon as a good footing is reached, which in places is 10 ft. or more above the elevation to which the floor of the dock must be excavated. The dock is provided with an intermediate sill by which it is possible to make use of it in two compartments, one 668 ft. long and the other 520 ft. long. The elevation of the dock floor is 38.25 ft. below mean low water. The entire interior wall surface of the dock will be finished with cut granite. The pumping plant will consist of three 54-in. centrifugal pumps each operated by an 1120-hp., 3-phase, 60-cycle motor using current at 2300 volts, and capable together of emptying the entire dry-dock in about two hours with the caisson gate closed at or near low water. The pumps will operate at 240 r.p.m., and are specified to have an average capacity of 80,000 gal. per min. each of sea water, this capacity varying with the fall of the water inside the dock. It is understood that they are to be tested at 100,000 gal. per min. each.

Prior to the execution in the fall of 1915 of the present construction contract, bulkheads had been built on the South Boston flats by the Commonwealth of Massachusetts, inclosing the area of the site except at its eastern end. The space between these bulkheads was filled in by hydraulic dredging of some nearby channels. This left the site inclosed on two sides by filled areas, and on the third side by the shore. This land is to be brought up to 16 ft. above mean low water and on it are to be erected eventually the various shop buildings necessary to the operation of the dry dock. Considerable settlement, which is now at an end, took place over the filled areas.

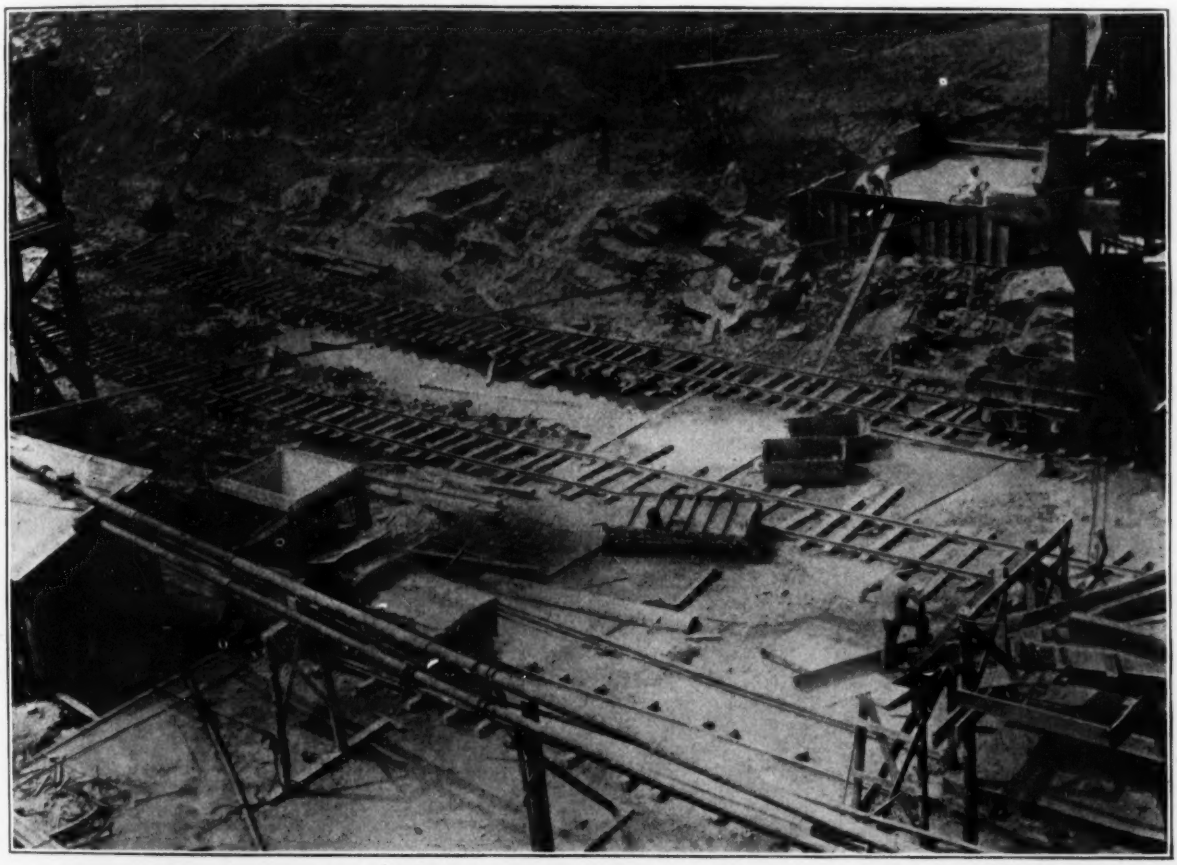
Of a totally different type from the cofferdam for the Forty-sixth Street Pier in New York City, built by the same contracting firm, which surprised engineers by the small amount of leakage developed, the area pumped for the Boston Dry Dock has nevertheless proved practically as dry, though nearly four times as great as that unwatered for the pier. Although the entire site of the Boston Dry Dock was once in the harbor, it is now inclosed on three sides by extensive fills and on the

fourth by a cofferdam only about 500 ft. long, the water outside of which is about 25 ft. deep; while the cofferdam at the Forty-sixth Street Pier, approximately 800 ft. in length, stood in about 30 ft. of water. The Forty-sixth Street Pier cofferdam was kept dry by a 10-in. and a 6-in. pump, each running about half the time, while the Boston Dry Dock cofferdam and fills are so tight that the leakage at high tide is balanced by a single 6-in. centrifugal pump throwing a measured discharge of about 1100 gal. per minute.

The pumps at the Boston Dry Dock have been set at the site of the rudder pit, which was excavated and used for a sump. Two 6-in., one 4-in., and one 3-in. pump, all electrically driven, are installed to provide against contingencies and give extra capacity for handling the water from heavy rains. Whichever pump is in steady use is controlled by a switch operated electrically by a float in the sump which is connected with an automatic compensating starter.

The earth over the site of the dry dock was excavated by a large clamshell dredge and dumped at sea between November, 1915, and September, 1916, during which time 629,900 yd. were taken out. About 550,000 yd. of dredging remains to be done in the approach channel leading up to the dry dock. Most of this material will be distributed as fill over the areas between the bulkheads on the north and south sides of the dock area. Within the cofferdam most of the excavation has been carried on with two Marion steam shovels, although a good deal of material was removed with the 750-ft. Lidgerwood cableway spanning the dock. Some rock and earth have also been removed with locomotive cranes and a stiffleg derrick located just east of the apron at the outer end of the dock.

The rock encountered was found to be finely laminated slate, which broke out in thin sheets. This made it entirely unsuitable for crushing to use in concrete or for plum stones in cyclopean masonry. The formation dips about 50 deg. to the north, and its surface is very irregular, rising from an elevation 15 ft. below the dock floor at a few points to 28 ft. above the floor in other places. The large, thin slabs into which much of it breaks up under blasting are easily crushed by the steam-shovel teeth. The heaviest part of the rock excavation, lying along the south side of the dock site, has been taken out so far by a No. 76 model shovel, while a No. 60 model shovel is operating along the opposite side of the dock. This work was begun at the east end and carried west, but the movement of these shovels has been reversed at times when the area to be excavated made this shift advisable. In general, the rock is taken out to subgrade. Between 85,000 and 90,000 yd. of rock are to be removed, of which the monthly estimates showed about 45,000 yd. to have been removed between Jan. 18, 1917, and Sept. 1. This rate of progress, owing to many delays during that period, does not approach the maximum rate of removal possible under favorable conditions. The larger shovel on



CONCRETE CAR AND LOCOMOTIVE AT LEFT ARE LOADED BY CHUTE IN WHICH MAN IS STANDING

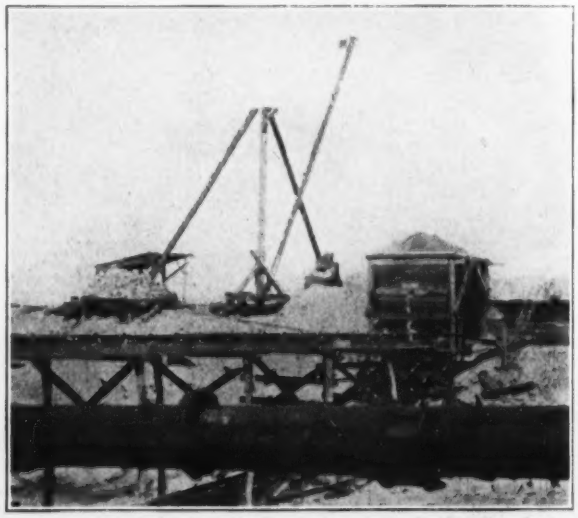
several days has excavated from 800 to 950 yd. and could improve greatly on this record if material could be removed from the hole at a more rapid rate. From the first of September until Dec. 25, however, 30,000 yd. of rock and 35,000 yd. of earth were excavated, leaving about 10,000 yd. of rock and 8000 yd. of earth yet to be taken from the dock area. During the cold months attention is being concentrated on the excavation for the dock floor drainage conduits, where 8000 yd. of rock are to be removed by hand. This work is to be complete early in the spring so that the conduits and dock floor may be placed, making possible a more convenient track layout for the transportation of materials in the dock.

The rock is drilled for blasting with two to six Cyclone well drills which put 6-in. holes down to subgrade. Low-freezing 40 per cent. Rendite is used, and it is estimated that about 2.39 tons of the slate rock are loosened per stick of dynamite, or about 3.82 tons per pound of dynamite. In the average large blasts about 2200 sticks or 1375 lb. of dynamite are used. In a few cases, however, as much as 1¾ tons of dynamite have been set off in a single blast. In addition to the well drills, Ingersoll-Rand Butterfly drills, first operated by steam and later by compressed air, are used. After the main excavation was well advanced a large number of these drills were employed in getting out the conduit channels and the excavation for the pump well area. In addition to the rock being removed, the steam shovels are excavating 55,000 to 60,000 yd. of earth which could not be taken out by the clamshell dredge. All of this material is being used toward filling the area around the dry dock, which will later be brought up to the finished grade with the hydraulic excavation from the approach channel.

The rock excavated by the steam shovels is removed by trains of three 12-yd. air dump cars. Three of these dump trains, hauled by locomotives weighing 39 tons and with 25-ton tenders, are as many as can be operated on account of the delay and difficulty in switching back and forth in climbing out of the hole. Several switchbacks are used in making the 55-ft. climb between the floor of the excavation and the dump. The average load of earth secured under these conditions is about 10 yd. per car, while the rock loads average about 8 yd. The average haul is estimated at about a mile, although the dumping areas are continually changing, the material being deposited on first one side of the site and then on the other. At least half a mile of this haul is consumed in climbing out of the excavation. The lift and length of haul has largely affected the amount of material which can be removed during the 10-hour working day. The capacity of the dump trains is not equal to the capacity of the two steam shovels.

Sand and gravel for concrete are received in lighters from Scituate at a pile dock built along the cofferdam. The sand is unloaded by a stiffleg derrick at the north end of this wharf, dumped into a large hopper and discharged through a cast-iron hopper gate onto the belt conveyor feeding the sand bin above the mixers. The hoisting engineer operates both the derrick and the hopper gate during concreting. Along the southern section of this wharf is a standard-gage track on which a 15-ton crane operates, loading gravel and piling it over a series of six hopper gates in the roof of a timber tunnel inside the cofferdam, in which is located a belt conveyor. This conveyor discharges gravel let through one of the hopper gates into the main gravel conveyor, which is at right angles to it and parallel to the sand conveyor, and which carries the gravel to the main storage bins over the mixers. The belt in the tunnel is about 145 ft. center to center of pulleys, while the main gravel belt is 175 ft. long and the sand belt 215 ft. All of them run on troughing rollers with return rolls and side guide rolls. They are all operated electrically, the gravel belts by 5-hp. motors and the sand belt by a 10-hp. motor. The belt speeds are approximately 300 ft. per min. with a delivering capacity of about 115 tons of sand and gravel per hour for continuous operation.

For the first concrete plant cement is stored in two houses near the north bulkhead and is received by rail. These houses are marked off on the floors into 8-ft. sections, each of which holds a carload of cement. Through the center of the first house runs the conveyor



DERRICK DUMPS SAND INTO HOPPER OVER BELTS

belt, which is entirely boarded in after it leaves the house, and which discharges the bags of cement into a metal covered chute in the mixer house close to the cement hoppers. The cement belt, about 265 ft. long, is driven by a 5-hp. motor, its speed being about 250 ft. per min. When tested cement is received by rail it can be unloaded directly on this conveyor by a short length of belt operated from the tail pulley of the belt. The short conveyor is on a pivot and can be lowered to the floor of a box car standing outside the cement house. The second cement house is used only for storage, and the cement in it must be loaded on flat cars and carried to the belt in the main house. While the sand and gravel belts are of 5-ply 18-in. rubber, with ⅛-in. of rubber cover and molded edges, on 32 oz. duck of the best quality, the cement belt is of thick 6-ply 18-in. canvas.

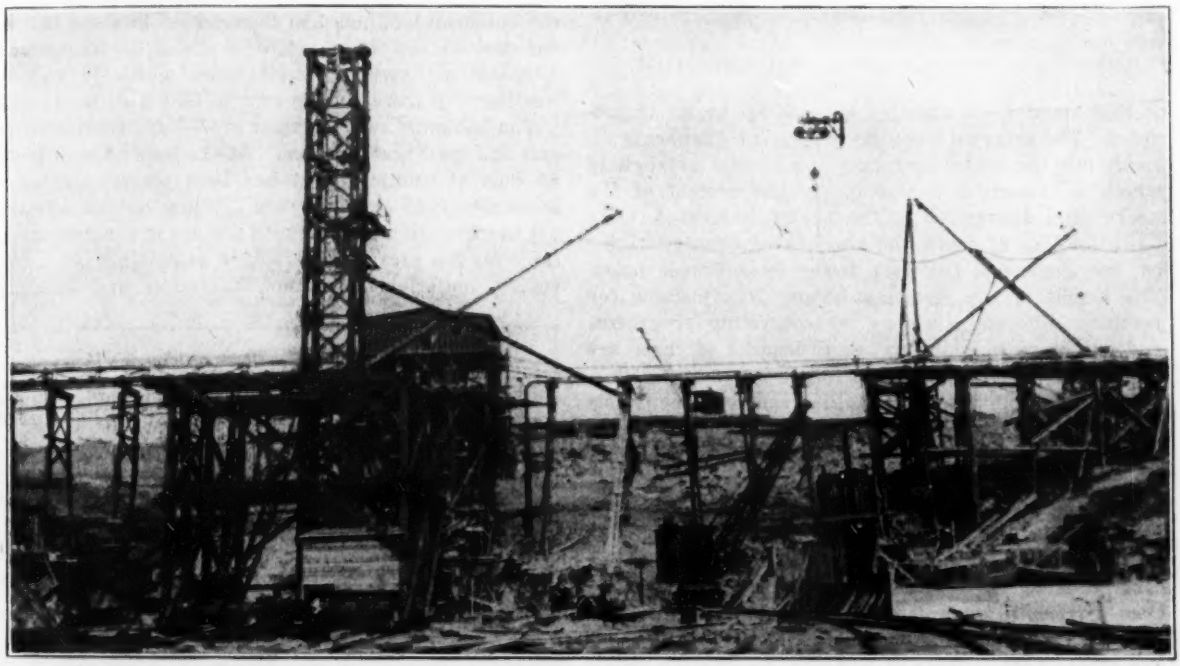
The mixer house is a timber structure 56 ft. 6 in. high from sills to the ridge of the roof, and about 20 x 24 ft. in plan. It has four stories, and the sills are set on rock about 11½ ft. above the subgrade of the dry

dock floor. The cement, sand and gravel belts are carried to it on trestles, while a trestle walk level with the upper story is also built to the south side of the inclosure. At the bottom of the house are located two 44-ft. mixers set back to back, which brings their charging hoppers together. Each mixer is operated by a 25-hp. motor making 1200 r.p.m. The mixers, geared to 14 r.p.m., are capable of delivering 1 yd. of thoroughly mixed concrete per min., giving a combined maximum theoretical capacity of 120 yd. an hour. Under operating conditions this total is figured at 100 yd. per hour.

Special metal chutes were constructed to take the place of the batch hoppers, which were not purchased with the mixers. The automatic water tanks were also detached and placed on the charging floor above, so that all levers could be operated together. On the charging floor are the two measuring boxes, which are lined with ¼-in. plate and subdivided in the proportion of 1 to 2 for sand and gravel. These boxes were built larger than necessary so that metal strips could be placed on their sides to mark the height to which sand and gravel should be filled, as the quantity will vary with the mixtures specified for different parts of the work.

Into the gravel compartment of each measuring box enters the lower end of the cement chute from the top floor of the mixer house. These chutes pass down through the bins, and are of timber construction. Each chute is 8 x 12 in. except at the lower end, which is made of a length of 10-in. iron pipe extending low enough to be covered by the gravel charge. The sand charge is first placed on its side of the measuring boxes, and then the gravel charge, after which a gong is rung on the cement floor by means of a cord extending to the charging floor and the cement charge is sent down the chutes, the gravel around the lower end of the cement chute reducing the dust to a satisfactory minimum. At a signal from the operator on the mixer floor the full charge of cement, sand and gravel is sent down into the mixers, after which the lever on the automatic water tank is pulled and a fixed amount of water, determined by previous test, is discharged into the mixers. The water charge has been fixed at about 8 lb. per cu.ft. of dry aggregates, including the cement, this quantity being found satisfactory for making concrete which will run through chutes hung at an angle of about 22 deg. with the horizontal.

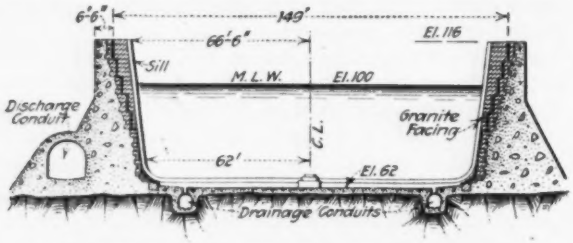
The bins located above the charging floor hold a total of about 130 tons of material, one third sand and two thirds gravel. The floor on which the cement is received above the bins is capable of carrying about 150 sacks of cement in storage. The upper part of the cement chutes end in flaring hoppers set in the floor into which six bags of cement are emptied for each batch and held until the signal is received, when levers attached to sliding metal gates at the bottom of each hopper are pulled, dropping the batches about 25 ft. There is a ventilator in the roof over the cement floor, six openings in the sidewalls, and in addition the cement loading crew is provided with respirators.



TRAVELING TOWER IN FRONT OF MAIN CONCRETE PLANT—GRAVEL CRANE ON COFFER IN BACKGROUND

The discharge from the mixers is carried in metal lined chutes inward under the mixers to a main outlet chute which discharges into a 75-cu.ft. hopper car. These chutes are built on an angle of about 27 deg. The car, which is standard gage and is shown in one of the photographs, is propelled by a 35-hp. gasoline locomotive from the mixers to the central concrete tower, which travels up and down the dock. The rate of delivery, of course, depends on the speed of this car and the distance traveled. So far the gasoline locomotive has kept up with the capacity of the tower, and when the work progresses toward the opposite end of the dock use will be made of a second plant. So far the mixing capacity of the first plant has proved slightly greater than the placing capacity.

The distributing end of the concrete plant consists of a large and heavy traveling frame 36 x 30 ft. in plan, running on sixteen 22-in. wheels on a 30-ft. gage track. It is 30-ft. in height, and in the center of the east end is located a 50-ft. timber hoisting tower, giving a total height of 80 ft. above the dock floor. The tower, 8 ft. square in plan, is guyed to the west end of the frame of the traveler and braced with heavy diagonal posts to the north and south sides of the traveler frame. Guys to the bulkheads, used at first, have been abandoned. The plant is equipped with a 2-yd. bucket and hopper.



CONCRETE TOWER TRAVELS ON CENTER LINE

A high-speed hoist operated by a 52-hp. motor is provided. The concrete from the hopper car discharges directly into the bucket by means of a hinged metal chute which is thrown into position by the descent of the bucket and disengaged as the bucket is hoisted. The 50-ft. sections of chute, the lower being counterweighted, are suspended from the tower by a timber boom. The height of the receiving hopper is adjustable for reaching different levels as the concreting progresses and one or more additional short lengths of chute are required to reach some of the forms.

To avoid the delay of hauling concrete the whole length of the dock, twelve hundred feet, a new concrete plant of 150 yd. daily capacity is now under construction at the southwest corner of the dock area. Materials are to be dumped over the bulkhead into large receiving hoppers which discharge directly into a 1-yd. mixer. By means of an elevator and chutes the concrete is to be conveyed to a stationary hopper built over a track running laterally behind the south wall. On this track a hauling engine and cable car will bring and return 1-yd. buckets as fast as a traveler can swing them into the wall. By this means it is expected that 25,000 yd. of the south wall will be placed without carrying the concrete more than 300 ft. in any direction. It is contemplated that a plant of similar design on the northwest corner will enable 25,000 yd. of the north wall to be placed. With the three concrete plants in operation it is estimated that 700 yd. of concrete can be placed in a day.

There are about 116,000 yd. of concrete to be placed, which, under average working conditions and making allowance for delays, requires a progress of about 400 yd. per 10-hr. day, which can be easily maintained with the plant installed and contemplated. Concreting was begun on May 1 last, and up to Dec. 25 33,000 yd. of concrete had been placed, averaging about 180 yd. per day for the entire period. During warmer weather a considerably higher average was maintained. During the months of November and December efforts were concentrated on the pump-well, where 3000 yd. was placed. This work involved the making of the drainage and suction conduits, suction chamber and pump-well walls, bringing the concrete up to the main floor so that the pumps may be placed at an early date.

The expansion joints in the dock are 60 ft. apart, and consequently the wall sections are concreted in 60 ft. lengths. Work was started at the east end of the dock next to the concrete plant, and except for a small portion at this end of the dock, the floor will not be concreted until the drainage conduits and the main pump-well have been completed. Steel forms and wood forms in 5 x 10-ft. panels are used for the walls, and collapsible steel forms for the conduits. The wall forms are wired to bolts set in the concrete inside the forms, using bracing on the outside of the lower sections where necessary.

There are 12,500 yd. of granite required in the dry dock walls. From Sept. 10 until Dec. 6, 1917, 2100 yd. of granite were placed in the dock walls, averaging about 30 yd. daily. This granite was sorted out at the bulkhead landings and transported into the hole on flat cars as fast as it could be placed by the masons. Preparations are now under way which in warmer weather will increase this rate to 60 yd. daily.

The cableway, with a span of 750 ft., travels on an east and west track system. At the base of each tower 80 tons of counterweight has been placed, making it unnecessary to provide guys. While not of effective use in excavating nor intended for use in concreting, the cableway has proved invaluable in assembling plant, conveying materials into the excavation and handling

CLOSING COFFERDAM IS SHORT

forms. Operated by steam, its maximum capacity is about 15 tons.

The compressor plant for the drills consists of an electrically operated 18 x 21¼ x 12¼ compressor for which a spruce pile foundation bedded in concrete was installed. Air is distributed from this plant, which is located at the west end of the dock, through a 6-in. main. Although some of the derrick engines are operated by air, this plant will not be under full load until the conduit excavation with hand drills is under way.

Because the dock will be one of the few in existence which can accommodate the latest battle cruisers and dreadnoughts, the work has been placed on an emergency basis and is being rushed to completion as rapidly as possible. Although the breach in the closure cofferdam delayed the work to some extent in the summer of

1916, the break was repaired without difficulty and the cofferdam has proved to be entirely stable. Since that date satisfactory progress has been made, the site being pumped, all of the plant equipment and trackage installed, most of the eastern half of the dock excavated practically to subgrade and a good start made on the wall concrete on both sides at the eastern end, including the discharge conduit tunnel on the south side.

The dock was designed and the contract let by the Directors of the Port of Boston, Frank W. Hodgdon, chief engineer. DeWitt C. Webb, civil engineer, U. S. N., was assigned by the Navy Department as consulting engineer on the details of design. The Directors of the Port of Boston were merged into the new Commission on Waterways and Public Lands in July, 1916, and that commission now has supervision over the construction of the dock. Frank W. Hodgdon continues as chief engineer with John N. Ferguson as engineer in charge in the field. The work is being carried out under contract by the Holbrook, Cabot & Rollins Corp., of New York and Boston, of which James W. Rollins is president. Alexander N. Lafferty is superintendent of construction, and Robert H. Griffin, engineer and assistant superintendent, succeeding the writer.

Cape Cod Canal a One-Way Route

In a recent issue of *The Nautical Gazette* some navigation difficulties in the Cape Cod Canal were brought to light in the statement that at a conference held in Boston between prominent shippers and representatives of the Federal Shipping Board, shippers complained of the frequent delays experienced in using the Cape Cod Canal, on account of the unreliability of depth and the frequent delays at the entrance. The vice president of the canal company admitted that the problem of shoals had not been solved yet, and that the geological and engineering advisers were puzzled to explain why some spots in the canal continued to shoal. The superintendent of the canal stated that the delays could not be avoided, as the canal was practically a one-way waterway, so far as barge traffic was concerned, as there was practically no towing except with the tide. Barges had therefore to wait outside the entrance for the tide to turn, when they did not arrive at the right time.

Activated Sludge Defined

In the definition of terms used in sewerage and sewage disposal practice, submitted to the Sanitary Engineering Section of the American Public Health Association in October, 1917, by the Committee on Sewerage and Sewage Disposal, the following definition of activated sludge appears:

"Activated-sludge process is the agitation of a mixture of sewage with about 15% or more of its volume of biologically active liquid sludge in the presence of ample atmospheric oxygen, for a sufficient period of time at least to coagulate a large proportion of the colloidal substances, followed by sedimentation adequate for the subsidence of the sludge flocculi; the activated sludge having been previously produced by aëration of successive portions of sewage and maintained in its active condition by adequate aëration by itself or in contact with sewage.

Highway Officials' Committee Reports on Tests and Investigations

After an exchange of views by correspondence, the Committee on Tests and Investigations of the American Association of State Highway Officials has submitted the following report:

(1) That the various conferences have revealed that there is a wide difference of opinion among the various testing engineers, and that a lack of correlated information on various subjects prevents the formation of conclusions which can be classed as final.

(2) The subject of standardization of forms and specifications was considered and recommendations relating to the gradation of aggregates and harmonizing of field and laboratory tests have been made to the Committee on Standard Specifications.

Your committee recommended, in view of the variety of conditions and materials, that specifications relating to materials should be prepared so as to maintain simplicity; that in describing aggregates, the dimension of revolving screens should be stated and for concrete surfaces, reinforced concrete and asphaltic concretes the gradation to be stated by laboratory screens. Your committee feels that the adoption of forms should be considered only as the necessity is apparent for the tests and investigations which are required. Forms for testing in the various laboratories and field tests should be arranged so as to enable the records to be kept correctly with the least expenditure of energy and time, and treated in the light of a book system in connection with any other business enterprise.

(3) In any statements made in specifications, your committee feels that due consideration should always be given to the materials available and the conditions under which tests are possible, and, wherever practical, field and plant tests should be developed and practiced subject, however, to a laboratory check.

(4) The engineer, before taking and submitting samples to the laboratory, should first acquaint himself with what the material is to be used for, and in submitting the samples should make clear the results desired, so as to enable the testing engineer to arrive at the required determination in the most practical and economical manner possible.

(5) Your committee feels that the different state departments can aid the cause of road construction by cooperating with the testing departments of the various universities and colleges established in the different states. Investigation in the form of theses made under the direction of trained professors and assisted by practical views of field engineers will be beneficial to the students, the institutions and to the states.

(6) The present transportation problems demand more than ever a close and careful study of the materials in each locality where road construction is contemplated. Your committee feels and would recommend that a careful material survey be made and methods of treating the materials in each locality be investigated and studied before attempting road work in that particular vicinity.

The committee is composed of A. D. Williams, chairman; J. H. Smith, secretary; D. V. Terrell and Julius Adler.

The 1918 Highway Program Should Be Considered from a National Standpoint

All Construction and Maintenance Should Be Dealt with in a Selective Manner—Uncompleted Links in Arterial Systems of First Importance, Especially in Regions Suffering from Freight Congestion

By L. W. Page
Director of the Office of Public Roads.

THE long haul is essentially a rail proposition. The short haul by reason of the phenomenal motor truck development of the past few years is becoming to an increasing degree a question of highway transport. This is the case, for the reason that the expenditure of time, energy, and money in drayage, loading and unloading represents an economic loss greater than the margin between the cost of actual transport by rail and by highway. Now that the tremendous strain on our rail transportation system, due to war conditions, has made necessary the consideration of every possible auxiliary means of transportation, attention is keenly focused upon the highways of the nation.

Considering it as fundamental that every enterprise must be dealt with primarily with reference to the great object of winning the war, it follows that all highway construction and maintenance should be vigorously pushed forward or postponed according to its measure of usefulness under this selective test. Naturally there would be a limited amount of highway work of a purely local character, which might not have any bearing upon the war and yet which could be conducted without interference with more important undertakings. This class of road building I am not considering in my analysis of the situation further than to mention it. With the main object in view, therefore, of rendering the highways most useful in this time of great stress, and so conducting highway work as to interfere in the slightest degree with other vital activities, and at the same time help in the fullest degree the winning of the war, we have for our guidance two basic principles: (1) That road building and maintenance for the period of the war must be considered from the standpoint of the nation; (2) that all programs of highway construction and maintenance must be dealt with in a selective sense.

Acting in line with these principles, the specific highways which should be favored are those which are vital to the transportation system of the country and those which open up new sources of supply to needed commodities.

Short Stretches to Complete Trunk Lines

The first of these classes must include the great trunk lines which form the arteries of our respective state highway systems and such links as are necessary to unite these systems into a national system. As a matter of fact, thousands of miles of these important trunk lines have already been nearly completed, and it means only the construction of short stretches to fill existing gaps in order to make long through routes available, over which motor trucks may move for the transport of materials necessary for the conduct of the war.

In the second class would come specifically those highways which may be constructed quickly and which make possible transportation to the railroad or to the points of consumption of great quantities of food or other essential products. As an illustration, there might be a large irrigation project with tens of thousands of fertile acres ready to yield up a rich harvest and needing only the construction of a passable road to get its products where they will do the most good.

Federal Funds for Selected Routes

How this selective treatment of the highway problem as a national undertaking can be successfully put into operation constitutes as important a question as the establishment of the fundamental principles. At the present time there is an appropriation of $75,000,000 of Federal funds to aid the states in the construction of public highways—the states being required to provide at least an equal amount. The agencies through which this act is operative are the Secretary of Agriculture of the United States and the state highway departments of the respective states. Manifestly, the 48 state highway departments working in coöperation with the Secretary of Agriculture could establish a selective program bearing upon the construction of those highways involving the expenditure of Federal funds, and it would be a comparatively simple matter for them by voluntary agreement to extend their combined consideration to the highways other than those on which the Federal funds are expended. Presumably the relations between the state highway departments and the counties are such as to enable the establishment of coöperative arrangement all along the line with the extreme localities.

Now that all of the railroads are under Federal control, it should be possible for the Secretary of Agriculture to lay before the Director General of Railroads, as a result of the coöperative dealing with the state highway departments, all needful information to enable him to take such action with reference to the supplying of freight cars for hauling road materials as the situation would seem to warrant and the facilities at his disposal would make practicable. Unquestionably all of the interests of the nation cannot be safeguarded and conserved in equal degree, and loss must be suffered at some point: but at least if it should be found in the last analysis that even the most important highway construction must be curtailed, the country would have the satisfaction of knowing that the action of the National Government was taken in the light of a full knowledge of all the facts and not through the arbitrary exercise of power.

Many hundred millions of dollars have been invested in public highways. The best types of these highways

are not surpassed in any country in the world. First and foremost these highways must be maintained, because the failure to maintain them will cripple highway transportation, throw a still greater burden upon the railroad, and delay us many years and require enormous expenditures in restoring our important highways after the war to the point of excellence they now have.

As to the parts of the country which should be given most serious attention in the matter of highway construction, it would naturally seem that as the movement of supplies is chiefly to the Atlantic seaboard from interior points, every effort should be directed toward filling in the gaps in the main east and west trunk lines: such, for example, as those which traverse the territory in which the railroads are now congested by reason of the shipment of mining and munition products, so that the highways may as far as practicable relieve the railroads of the less bulky freight and that which is to a considerable extent local in character, thus leaving the rail lines free for the movement of the commodities vitally needed. Fortunately most of the Eastern states have excellent systems of state highways far along to completion and the task of putting them in shape for the heavy traffic due to war conditions is a slight one compared to what it would have been ten years ago.

Finally, time is the most important element in dealing with the problem of highway construction, maintenance, and transport. Action must be taken quickly by all parties able to coöperate. Already the Office of Public Roads has sent out schedules to the state highway departments for the selective listing of all Federal Aid work for 1918, which, however, is a relatively small part of the total. As soon as this information is received it will be coördinated and placed into a program of work embracing the entire 48 states.

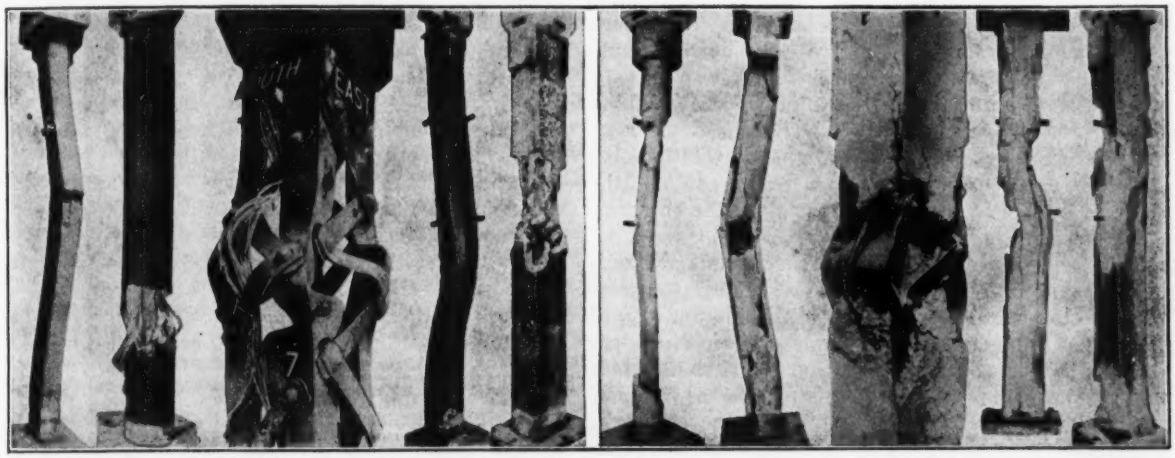
P. R. R. Has 100,000 Stockholders

The number of stockholders of the Pennsylvania R.R., for the first time in the history of the company, has passed the 100,000 mark—the exact number shown in the monthly statement made public, Jan. 21, being 100,038. Of these, 49,492 are women. The total number of stockholders increased 9650 last year.

Fire-and-Load Tests of Columns Show Characteristic Distortions

FIRE-AND-LOAD tests of about a hundred fireproofed columns are being carried on at the Underwriters' Laboratories, Chicago. Views of some of the specimens tested, sent us by W. H. Merrill, president of the laboratories, prove the similarity of their behavior to that of columns in actual conflagrations. A group of the views is reproduced herewith. Numerical results are withheld until the entire series has been completed, but it is stated that the time of failure of columns under the conditions has varied over a wide range, from 17 min. for an unprotected column to over eight hours for heavily fireproofed columns.

The test apparatus consists of a brick furnace 7 ft. square and 12 ft. high inside, over which is mounted a hydraulic press of 256 tons capacity. It is heated by gas burners which are regulated to increase the temperature at a predetermined rate, the same for all specimens, up to 2300° F. at the end of eight hours. Hose streams can be applied if desired. The temperatures of furnace and of column are measured by pyrometers, and the vertical compression or expansion of the column is measured on a 37-in. gage length near the upper end. A view of the test furnace was shown in *Engineering News-Record* of Aug. 2, 1917, p. 215.



COLUMNS SHOW TYPICAL FORMS OF FIRE DESTRUCTION IN FIRE-AND-LOAD TESTS

As each test is continued to complete failure, the views here reproduced are not subject to comparison except with respect to the general type of the failure deformation. They show effects very much like those observed in the Baltimore and San Francisco conflagrations and the Edison fire. This fact gives assurance that the test results will be directly applicable to the service of columns in actual construction.

Engineers and architects are welcome to visit the laboratories when in Chicago, and to see the column tests going on, Mr. Merrill informs us.

Steel columns of various forms, protected by concrete, tile and other kinds of fireproofing, and several reinforced-concrete columns are included in the series. One interesting feature of the results so far obtained is that concretes of different aggregates differ by more than 100% in resistance to fire.

Present-Day Conditions Are Forcing the Engineer To Assume New Responsibilities

The War Indicates That the Schools Must Prepare Him for the Control of Capital, the Interpretation of the Daily News and the Organization of Industry and Commerce

By C. R. Mann
New York

(Dr. Mann has been engaged for three years in making a study of engineering education for the four national societies of civil, mechanical, electrical and mining engineers, and the Carnegie Foundation for the Advancement of Teaching. He therefore speaks with full knowledge of methods now employed in the schools.—Editor.)

THREE years ago most of us thought that a world war could not last long because, however much kings and kaisers might wish to continue, the bankers would stop it. But the financiers have not come up to our expectations in this matter, and we have therefore been compelled, unwillingly perhaps, to recognize that money is not the ultimate measure of national strength. National credit is the result and not the cause of intelligent industrial production: the engineer, not the banker, is the real power behind the throne.

This fundamental fact now seems so simple and self-evident that it is rather hard to remember the time when we thought otherwise. But though the rugged outlines of this fact are now sharply silhouetted against the ruddy dawn of the new age, the details of its meaning are but simply descernible through the haze of speculation over the significance of the struggle. Naturally the engineer is intensely interested in the development of the details of the picture, for on him devolves the duty of interpreting the coming conceptions in terms of materials and organizations of men. And if education makes men, engineering education must be the first to feel the thrill of the dawning day.

Three elements in the picture can now be plainly perceived. These indicate that the engineer is henceforth vitally involved in the control of credit, in the interpretation of the daily news, and in the organization of industry and commerce to make goods cheap and men dear.

The Engineer as Banker

In performing the first of these new functions the engineer becomes the partner of the banker to determine which projects are worthy of financial support and which not. As the engineering spirit is more and more infused into this dispensing of credit, public service rather than excess profit becomes the inspiration for enterprise; intelligence in production becomes the best security for loans; ability to deliver the goods becomes the sure basis of financial success; and the control of tools gradually passes from the hands of those who own them legally into the hands of those who can use them effectively.

Newspapers and periodicals already sense the expansion of the engineering spirit in the struggle to make the nation strong. The distribution of wheat, the supply of sugar, the transportation of coal and the price of bread are now subjects which occupy an amount of space in the daily press that only a sensational trial formerly could command. The public has never before realized how vital and how interesting factories, freight cars, warehouses, terminals, trucks and ships really are. Some faint conception of the necessity of organization for the common project of liberating life by winning the war seems to be taking shape, while an impelling desire to serve and to subordinate personal preferences to community interests appears to be dimly developing. These faint feelings of fraternity may grow into driving impulses—if editors continue to extol engineering enterprise rather than private profit in their interpretations of the daily news.

Engineers and Chambers of Commerce

In many communities chambers of commerce or groups of engineers have organized to build up business and boom the town. Through their efforts living conditions have been improved and many a city is being made a better place for homes. But the progress has always been hampered by the vested rights of individuals and of corporations, so that none has yet dared to envisage an entire community as a single working plant for the purpose of organizing it for the most intelligent production of human wealth. This can now be done. The war is opening many hitherto blind eyes to see that each gains more than he loses when he merges his strength with the might of all in an organization that is constructed for the purpose of releasing creative energy by giving each the work he is best qualified to do.

The time has come for such an organization in every community and every state, because the Federal Government is struggling to shape the nation into an organization of this type. Only so may the nation be strong, only so may communities add their utmost to the nation's strength. The responsibility for this work must finally be shouldered by engineers who are both masters of the mechanic arts and moulders of men.

For many years this country has been drifting toward the realization of these requirements. The war has but accelerated the process and precipitated conclusions that were bound to come, otherwise men trained by experience to met the present crisis could not now be found. Continuity demands that the same conclusions remain valid long after the war is ended. Therefore, engineer-

ing schools will render service in proportion as they grasp the implications of these conclusions and express them effectively in the daily work of instruction.

The possible conclusions for engineering education are many and complex; but two stand out in bold relief, namely, there must be closer coöperation between school and industry, and there must be more attention to the appraisement of values and costs.

The Spirit of Investigation

The essential feature of the coöperation with industry is not the skill, the knowledge of workmen, or the feel of the machines which the student acquires from shop experience. Important as these are, they cannot compete with the spirit of investigation which must develop if the coöperation between school and industry is real and vital. There are thousands of unsolved problems in even such rough shop work as freshmen are permitted to do. The boy should be trained to discover these unsolved problems and to bring them back to school for discussion and solution. By making shop work in industrial plants the source of problems for solution in school, and by relating the class and the laboratory work in some degree to the problems raised, conditions most favorable to the self-development of the student may be realized. As he progresses, the problems become more and more intricate; until in his last year, if he has shown real engineering ability, he may be assigned as helper in industrial research, either at the plant or in the school laboratories. After such a training in defining and solving problems, closely coördinated with instruction in science and drill in mathematics, he should be able on graduation to take a responsible position without serving several years as an apprentice, as is usual under present conditions.

Industry Ready To Coöperate

To the faculty this type of coöperation with industry brings incentives for creative work in production and in education. For coöperation makes the school the source of solutions of industrial problems, not only with respect to the technique of manufacture but also concerning the correlation of the community's productive processes with the training of its citizens as intelligent workers. Hitherto manufacturing companies have stood aloof and regarded one another with suspicion—and the Federal Trade Commission discovered that 200,000 of them are not paying expenses; but now they are ready to coöperate. Similarly in education, many manufacturers are supporting corporation schools to train their own help, while more than half the children in the entire country quit school at the sixth grade without being trained to earn a living. But they too are now ready to coöperate. If the men who are teaching in enginering schools would rise to the responsibility and organize for the systematic study of community production, they soon could create a true university, with its feet firmly planted in industry and its soul consecrated to the task of utilizing science and literature to liberate the creative energies of men.

While close coöperation between school and industry gives that practical experience which is essential for mastery of the mechanic arts, it is not in itself sufficient to enable the schools to meet adequately the fundamental requirements of engineering in the new epoch. The Germans are technically well trained in the mechanic arts, yet they are but brutally strong. In order to strengthen the nation by infusing the engineering spirit in the control of credit, in the interpretation of the daily news, and in the organization of industry for the production of human wealth, the engineer must have sound judgment in the appraisement of values and costs. This requires not only an understanding of finance and the meaning of money, but also a sympathetic appreciation of the things humanity holds most worth while. Even a practical project like building a bridge is ultimately controlled by some man's decision that the resulting value is worth the cost; and this decision is more difficult and subtle when it concerns profoundly the production of human wealth and the appraisement of human values and costs. The engineer is too often obliged to be only the employee of the bank, the corporation, or the state commission, because he believed that engineering is wholly a matter of technical skill; when, in truth, control in this, as in everything else, is really vested in the decision of the question of whether the game is worth the candle.

Schools Need New Point of View

Training in the appraisement of values and costs does not require the addition of formal courses for that purpose, but rather the injection of this point of view into every branch of school work. For example, experiments in chemistry need not always be of the type: *Analyze this baking powder.* The project: *Make baking powder and find out if it is cheaper and better than any you can buy,* is vastly more effective as a training exercise.

Presented as a personal effort to appraise the human values and costs in life's experiences, literature fascinates engineering students. Economics delights them when it is a critique of proposed solutions of the social problems defined by their daily coöperation with labor. Such exercises also foster the development of those homely virtues which always make the working people the bulwark of a nation's strength—the sense of justice, feelings of neighborly kindliness, devotion to right and respect for God and man.

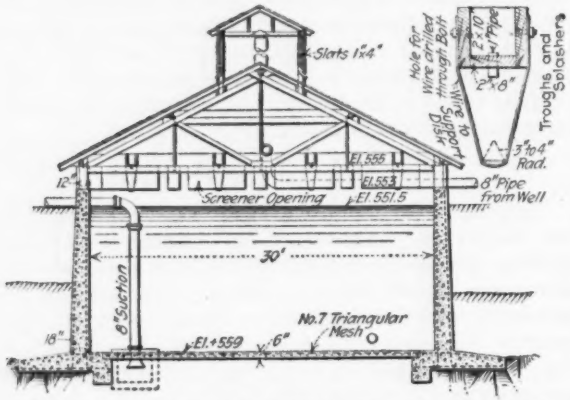
A Profounder Philosophy of Life

Thus because the war has revealed a profounder appraisement of human values and costs, and because the war has hastened the transformation of the individualistic man selfishly seeking his own personal profit into a community man willing to do his best for the common welfare, the ideal that was set for the engineering schools in the passage of the Morrill act in 1862 may now be achieved. For many of the first schools founded under that act were called "Industrial Universities"; but they soon dropped the "industrial" from their titles, fearing lest they lose caste in academic councils. But now, if they gladly grasp the opportunity opening before them, they will claim with pride their abandoned surname and proceed to demonstrate that the engineer, the creator of a new earth, is also the prophet of a profounder philosophy of life.

Splasher System Cools Artesian Water-Supply

Abnormal Demand for Water in Sprinkling Season, Although Services Are Metered, Forced Development of New Device

ARTESIAN wells delivering hot water are utilized in some of the suburbs of Dallas, Tex., regardless of the temperature. In Highland Park, however, which is one of the higher grade residential districts, the former practice of passing the small supply needed through a series of coils in a small lake has recently been superseded by a simple splasher arrangement which does not curtail the flow from the well as was done by the head consumed in passing through the coils. The well is 2800 ft. deep and 6 in. in diameter. It yields 600,000 gal. of water daily, having a tempera-



COOLING SPLASHER DEVICES ARE LOCATED OVER STORAGE RESERVOIR

ture of 109° F. The consumption has become so great that the capacity of the pumping plant had to be doubled and greater storage capacity provided to carry the load over periods of high consumption during the sprinkling hours, for although the supply is metered no money consideration prevents the use of abnormal amounts of water for this purpose in this district.

Simple splashers that could be applied without restricting the flow were built over a rectangular reinforced-concrete reservoir. Studies were made of published data on experiments with splashers for sewage sprinkling filters, but it was realized that the problem was quite different and that it would be necessary to experiment more or less to get the best results. In consequence the apparatus was built along the cheapest possible lines, arranged so that the splasher disks could be raised and lowered to get the maximum amount of cooling. As shown in the simple details, the disk is suspended by No. 10-gage galvanized wires soldered to the bottom of the splasher and passed through holes drilled in bolts extending through the sides of the distributing troughs. Discharge from the troughs is through 32 pipe nipples, each 1 in. in diameter and 4 in. long, provided with square countersunk adjusting nuts on the upper threaded end. Four troughs extend the long way of the 30 x 60-ft. reservoir and are fed at each end by a connecting trough supplied by 6-in. pipes direct from the well. The troughs are set 2 ft. above the top of the reservoir walls, with the disks hung at the same elevation as the top of the walls.

Without the monitor roof the splashers cooled the water 11° F. during the hot summer days, but the ventilation was not sufficient to remove a great amount of steam which accumulated under the roof. As soon as the monitor was added the air under the roof became clear and the water was cooled at least 15° F. in summer when the maximum temperatures ranged from 90 to 100°. With this reduction complaints from consumers ceased.

N. Werenskiold, consulting engineer, Dallas, designed the reservoir and cooler along with the other improvements of the water-works system, which is owned by the Flippen-Prather Realty Company.

Finds Motor Trucks Can Build Cook County Hard Roads

MOTOR-TRUCK haulage of road material direct from existing stone quarries or gravel pits to the construction work can serve one-half of the 50 miles of roads designated in the $1,000,000 bond issue authorized last fall by Cook County, Illinois. This is the conclusion of B. D. Barker, superintendent of highways, after a careful examination of available sources of supply.

The following details are given as indicative of what many other counties may be able to do to get roads built without increasing the freight congestion, and in spite of embargoes on rail shipment or road materials. The truck haul to the Holmwood-Lansing 8-mile stretch will average two miles. There are two sections of six miles each on Archer Road leading to Joliet, with hauls of two and three miles, respectively. Five miles of the Des Plaines River Road can be reached with a 3-mile haul. Unfortunately, the section of the Chicago-Milwaukee road in Cook County can be served virtually by rail only. The route parallels the North Shore electric lines, on which material has been shipped from gravel pits in Wisconsin, but the 5- or 6-mile haul would ruin existing macadam roads, and the material is not considered entirely satisfactory without expenive washing and additions of larger sizes.

From the 1917 contracts there still remain uncompleted of this amount a 5-mile stretch distant nine miles from the quarries at Lamont and an 8-mile stretch on 95th St., 2½ miles away. The remainder requires rail deliveries with from 1- to 5-mile haul from the nearest sidings. The longest stretch, 16 miles of the Higgins Road, passes through undeveloped gravel pits where washing equipment only is needed to make the whole stretch independent of rail delivery.

Of the 11 miles to be built with the aid of state funds, only 3¾ miles could be built by existing motor trucks only. The hauls would be five to six miles, while the railroad sidings are within one mile of the work.

Cement for the concrete roads must be obtained by rail, and in the quarry section sand must be imported. Better arrangements are looked for this year, and less tying up of jobs because of the failure of sand and gravel companies to deliver sand to broken-stone jobs. Four jobs were tied up last season on this account, although cars seemed to be "available" if the contractor bought both sand and gravel.

Lessons Learned from Road Work in War Years Will Be Permanently Helpful

Freight Bureau Effects Many Economies and Shortens Delays—Construction and Maintenance Departments Coöperate—Careful Route Posting Saves Time and Money—Commission Takes Over Much Work

By H. Eltinge Breed
First Deputy Commissioner of Highways, Albany, N. Y.

THE stress attending highway construction and maintenance during the past year of scarce labor, scanty materials, high prices and general difficulties has taught some hard lessons. The value of their results may mitigate the distress of learning them. A doubtful experimentation was involved which, in normal times, would have been shunned as unnecessary by executives of ability. But many of these expedients have not only proved valuable under present conditions, but furthermore promise to be permanently helpful to normal highway work.

An unprecedented burden of traffic has fallen upon the highways, and a slowed-up delivery and scarcity of materials have impeded all work of construction and repair, as a result of which contractors have suffered heavy losses. This has hastened the establishment in the office of the highway commissioners of a freight bureau which promises to be the most important feature of the year's innovations.

The original idea in starting such a bureau was to have tabulated, for estimating purposes and checking bills, information about freight rates on all materials at any point within the state. We also thought that through this bureau we could check up existing rates and, where they were disproportionate, get reasonable reductions which would cheapen work or foster competition by making available several sources of supply.

The first step necessary in this work was to assemble the tariffs concerning commodities used in highway construction. Requests were sent to the tariff bureaus of each railroad for their published lists. To check these against the official tariff indices in the files of the New York Public Service Commission a filing system was installed which showed the tariffs of each individual road in numerical sequence, using the Interstate Commerce Commission number where given and where not, the Public Service Commission number. This system shows the class rate, demurrage and switching tariffs. The specific commodity tariffs applying on asphalt, cement, sand and other materials are indexed as well under the commodity, and all work is cross-indexed so that it can be readily found under the road, under the commodity or under the number. These tariffs are kept up to date and checked by means of the weekly tariff bulletin of the Public Service Commission.

It may readily be seen that in estimating work we have accurate knowledge not only of the cost of materials but also of the freight rates from the different sources of supply so that we can determine just what is most economical for the particular piece of work under construction. This information is also valuable in verifying the price assessed by the carriers on shipments where, as in much of our maintenance work, the freight has to be paid by the department.

Besides the collecting of data for purposes of estimating and checking, the work of the bureau has been broadened to include the analysis of commodity rates. If the published rate is not in line, or is unreasonably high in comparison with other rates quoted by other carriers under like circumstances, it is taken up with the carrier on which it originated. Usually, when it can be shown that the rate is out of line or high, a reduction is made. Reductions covering 24 individual transportations have thus far been made by the carriers.

Certain carriers had been holding to their own lines much traffic which originated thereon, even though this required moving shipments over an unreasonably roundabout route, where a division of the business with another line would have meant a decidedly shorter haul. The tendency of this practice was to keep certain producing points out of territory to which they were naturally tributory because of the high freight rates of the roundabout, one-line haul. This was prejudicial to the road following this practice, since the point so affected could not compete in certain territories. If the rates were maintained on the basis of the mileage and level which would naturally obtain on the two-line haul as the shortest route between a producing point and its destination, competition would have been kept open and the offending road would have had at least a part of the business. The representations of the Freight Bureau on this point were finally accepted by the roads and resulted in a reduction of rates to about 200 points.

Although in general the commodities which enter into the construction of highways are of such nature and volume that they have specific commodity rates established by the railroads to apply particularly to their movement, in some instances there exist no such rates. In the latter case the matter is taken up with the traffic department of the originating line and it is shown the tonnage that it will be possible to move if reduced rates are made effective. In most cases the desired reduction is obtained.

Usually all these propositions are taken up with the general freight agent, but if no relief is obtained from the railroad officials the matter is referred either to the Interstate Commerce Commission when the traffic is interstate, or to the Public Service Commission when the traffic is intrastate.

On account of the tremendous traffic the carriers have had to handle there has been a serious shortage of cars and frequent interruptions of service at congested terminals. This has perplexed all our work and interfered with progress. It has become a part of the daily routine

to call upon the carriers to furnish cars and to modify embargoes so that materials may move. This work has been facilitated by the data of the bureau. The request for furnishing cars is usually filed with the superintendent of car service of the line involved, and the request for the modification of embargoes with the superintendent of transportation. Relief has been granted in most cases, although occasionally it has been necessary to appeal to the Car Service Commission at Washington, which has aided us materially. In one instance, however, the matter was brought informally to the attention of the Interstate Commerce Commission and in another it was necessary to institute formal proceedings before the New York Public Service Commission. In both cases the relief was granted.

The bureau has also aided, when, because of slow shipments or sidetracking due to congestion, it has been necessary to trace cars. This has been done through the operating and the traffic departments of the railroads, the choice being determined by the better service one or the other would give. The fact that even at present 569,700 tons of imported material are necessary to complete work now under contract, while many times during the rush season there have been several times that amount, is good evidence of the importance of the work.

The burden thrust upon the highways by the overflow and delays of the railroads has emphasized an old lesson, one too often neglected by officials. This is the necessity of adequate routing by posted signs and by sending up-to-date information to publications and automobile clubs. Nothing occasions the traveling public more annoyance and loss of time and energy than uncertainty about routes. For instance, a farmer sends a new man with a truckload of perishable berries to the nearest shipping point. The new man meets an unmarked crossroad, takes the wrong turn, wastes half a day, arrives too late for shipment, half the berries rot over night, and the farmer condemns the highway department. Or the physician, motoring as the quickest way to reach a home of sickness, strikes a detour, loses his way, gets mired on a country road and nearly has nervous prostration before he reaches his goal. Such incidents are annoying enough at easier times; under the present high pressure of living and under the necessity for increased traffic from distant points they are unendurable. We have learned that effective guide-marks at intersecting points almost double the value of a road and are trying to post every detour beyond possibility of misunderstanding. Furthermore, we are telling about routes and those open or closed for repairs, and trying to have all publications give the public the latest instead of obsolete information that might have been true the month before last. To this end the department solicits correspondence with newspapers, periodicals, guide-book publications and automobile associations.

Another point particularly accented by the heavy traffic upon the highways is so obvious that we wonder now at its tardy realization. Many highway departments are divided so that construction work is cared for by one organization, and maintenance and repair by another. Where there are parallel routes between two points it is sensible that if one must be closed to traffic the other shall be kept open. Yet this year it has frequently happened that both routes were closed simultaneously—one for maintenance and repair, the other for new construction work. This condition was not intentional, of course, but was brought about by the inevitably slow progress on many contracts as a result of which construction work on some routes continued over two or three seasons, during which time it became imperative to do maintenance work on parallel routes. We know now that work in future must first be definitely planned with regard to the necessary maintenance and repairs on any route, so that no road need require the ninth patch for lack of the first. Then the construction work in the locality must be allotted so that it will fall on the same route as the repair work, leaving the alternate route free for uninterrupted traffic.

Another difficulty of this past season has been the inadequacy of labor, both in quantity and quality. Many contractors in New York State had still uncompleted large sections of work which they had bid in at comparatively low prices. In order to give them a chance to finish their work as nearly as possible in accordance with their estimates, the department decided to curtail the letting of new work, which, bid in at prevailing high prices, would give the successful competitor an unfair advantage due to his ability to pay higher wages to labor in a limited market. As it was, all the supply of labor available for highway construction purposes was utilized.

The curtailment of work made it necessary to decrease the engineering force, or there would have been a disproportionate charge against overhead expenses. The department was lightened to the actual number of men needed to do the work in hand efficiently. Then came enlistments and the draft. Today 145 of our engineers are in the national service, and it is impossible to get men of anything like equal caliber or experience to take their places. So the men who remain have worked under extra pressure, new methods and short cuts have been used, and the work has been kept up without taking on new people.

In spite of all possible help given to contractors having outstanding work, many of them failed. They simply couldn't meet the increasing cost of materials plus increasing wages and decreasing efficiency of labor. We started the year 1917 with 294 contracts in force. During the season we let 29 for new work and 14 completion contracts for work defaulted. This put a total of 1530 miles of work to be done under contract in 1917 (at which time about 530 miles of this was physically complete). As the season progressed a number of these contracts were defaulted. Eighteen of these were of extraordinary importance because they served communities for which it was necessary that traffic be moved and where the present roads were impassable. Something had to be done quickly. The obvious action was for the department to take over this work in spite of the additional labor it would mean for the decreased engineering force. This it did after due notification to the contractors, and after bonding companies had proved their inability to proceed with the work. The work taken over by the department covered 90.55 miles; the original contract price for it was $1,187,976.22. It comprised waterbound macadam, surface treatment; bituminous macadam, penetration method; bituminous

macadam, mixed method; cement concrete, and brick. The contractors had completed $441,000 worth of this work and the department since taking it over has expended $425,000. A number of the contracts are now entirely finished and some are so nearly completed that they can be finished in the first month of the coming season. Good progress has been made upon all of them.

Two lessons have been learned from this experience. The first pertains to legislative enactment. Many highway laws are so written as to preclude the possibility of the state department completing abandoned work. Such laws should be changed. In New York State the Department of Highways can intervene only on cancelled contracts. It would seem advisable that in emergencies adequate authority be given the department forces.

The second lesson sounds a cheerful note in a pessimistic season. We have proved that an organized highway department can be buoyantly independent. If it becomes impossible to proceed by the original contractural methods with work deemed of sufficient importance, then the department can take it upon its own shoulders and, from our records this year, do it quite as well and more rapidly than the contractor. This sense of power, the proved ability to meet difficulties, and the aroused public consciousness to the need of adequate highway routes throughout the nation, are perhaps compensation enough for the trials and discouragements of the year.

Coal Car Thawing Plant Built of Precast Concrete Units

Hot Air Is Blown All Around Trains of Cars Containing Frozen Coal Which Are Housed in Unit Concrete Building in Terminal Yard

By Scott W. Linn
General Contractor, Cleveland, Ohio

THE concurrence of the coal shortage and the unprecedented cold wave of the first week in January brought to the attention of the coal-using public around the tidewater ports their dependence upon some method of thawing out the coal so as to permit its being unloaded. Car after car reached the New Jersey-New York harbor ports with contents so hard as to resist almost any manual effort to release them. To meet such conditions where mechanical car dumpers are used large thawing plants have been installed at a number of terminals. These are enclosed houses in which cars or trains of cars are run, there to be heated by one means or another to a temperature which will thaw the frozen coal and permit its easy dumping from the dumper just along the same track. A number of such plants have been installed by the Walter S. Newhall Co., of Cleveland, Ohio, in the past few years, culminating in one of precast reinforced concrete at South Amboy, N. J., for the Eastern Coal Dump Co.

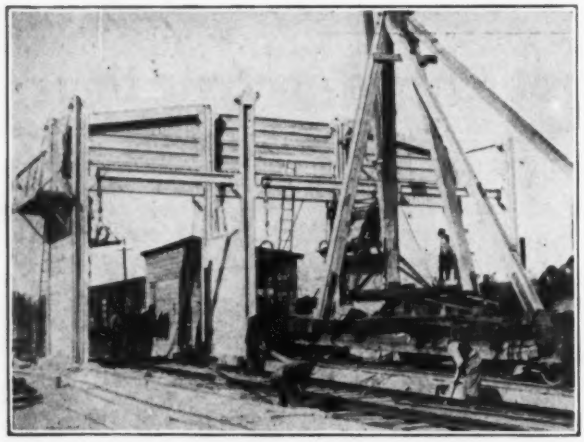
In the first thawing plant built for this company in 1910 a live steam point system was used. A boiler plant of estimated capacity was provided, and an underground main steam line laid from the boilers to intersecting steam lines parallel to and between railroad tracks. At intervals of about 20 ft. manifolds were used, to which several lines of rubber hose were connected. The other end of each piece of hose was attached to a malleable-iron casting on the end of a piece of 1-in. pipe about 10 ft. long. The opposite end of this pipe was pointed and perforated near the pointed end. These pipes were drilled or driven into the frozen coal and live steam admitted to the coal through the perforations.

A winter's use of this thawing system proved that it was not a success, especially in thawing bituminous coal. It was not economical in the use of steam and the handling of the points and hose was dangerous to operators. When a point was driven into the body of frozen coal instead of the steam being distributed through the coal for any distance the tendency was for it to thaw out a

ON THE LEFT THE OLD TWO-TRACK THAWING PLANT AT SOUTH AMBOY, ON THE RIGHT THE NEW THREE-TRACK PLANT

cylinder around the pipe, allowing the steam to escape to the top of the coal. This was particularly true in the case of bituminous coal or finely divided anthracite. This action of the steam made it necessary to drive in the points a considerable number of times in each car. When the coal was finally thawed the moisture from the condensed steam rendered it very wet. The coal was also in a heated condition and on cool days a visible vapor arose from it for a considerable time after a boat was loaded. This gave rise to a fear among shippers of danger of spontaneous combustion.

As a result of the various difficulties encountered in the point system a study was made of other proposed



ERECTING THE PRECAST MEMBERS FOR A COAL-THAWING SHED

systems of thawing in which the trouble mentioned might not appear. Several methods of combining and applying heat to cars were considered, in all of which it was thought to be economical to provide an enclosed building with insulated walls. Construction difficulties, cost of maintenance and other objections led to the abandonment of most of the schemes. The plan that finally appeared to be most practical from the construction and operating standpoints was the hot-air system used in the latest plants.

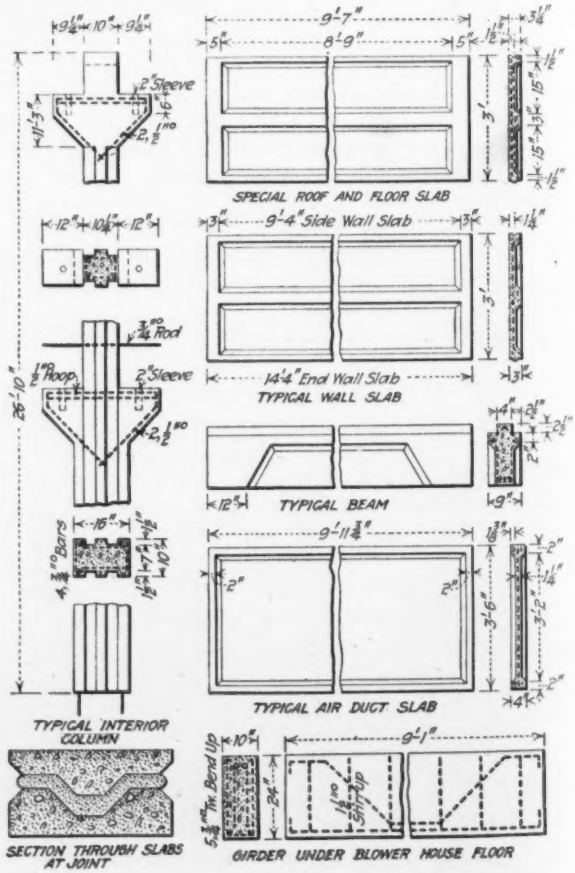
Early plants of this type were built of wood frames with insulated walls and roof and a later one at another site was of steel and concrete with insulated walls. Finally in 1916 the latest plant at South Amboy was built of precast concrete members under a structural system developed by C. D. Watson of the Precast Concrete Co., Cleveland, Ohio. This building, erected by the latter company under the direction of the Walter S. Newhall Co., as engineers and general contractors, is described in this article.

The building for the thawing plant is 570-ft. long and 48-ft. wide, spanning three tracks and having a capacity of forty-two 40-ft. cars. It is an enclosed shed with four longitudinal rows of columns, and walls making a separate room for each of the three tracks and carrying a roof sloping both ways from a central longitudinal ridge and an intermediate ceiling, the space between being utilized for the air ducts. In the middle of the length is a higher section 50-ft. long, in the upper part of which is located the blower. Structurally all the members are of precast reinforced concrete joined together in the usual manner of such construction. Each column is grooved as shown in the details to provide space for two rows of precast wall slabs which are let down into the slot, the space between being filled with mineral wool as an insulator. The roof and ceiling slabs are precast and set in place on girders and beams framing it to the columns. The wall slabs are 10-ft. long, 3-ft. wide, 1¼-in. thick with heavier edges and cross ribs. An asbestos covering was used on the roof slabs, and steel rolling doors were used for enclosures.

Boilers furnishing steam for the thawing plant are situated about 400 ft. from the apparatus rooms. The boiler plant was installed several years ago for the purpose of supplying steam for the live steam point system. It was later used for the first hot-air plant. It has been enlarged to accommodate both hot-air plants.

The building is divided longitudinally into three rooms. As each room covers one track and can be used as an independent unit with or without the two other rooms, three complete apparatus units are used. These units are duplicates in detail and arrangement and a description of one is applicable to all.

Each unit consists of one blower, one engine and two sets of heating coils. The engine is of the vertical enclosed type, and is direct-connected to the blower at a sufficient distance away to provide clearance for free return of air to the blower wheel. The blower is of the multi-vane double-discharge type and furnishes air in large enough quantity to give frequent complete change of air in the thawing rooms. Each unit has two sets of



PRECAST CONCRETE UNITS IN THE SHED

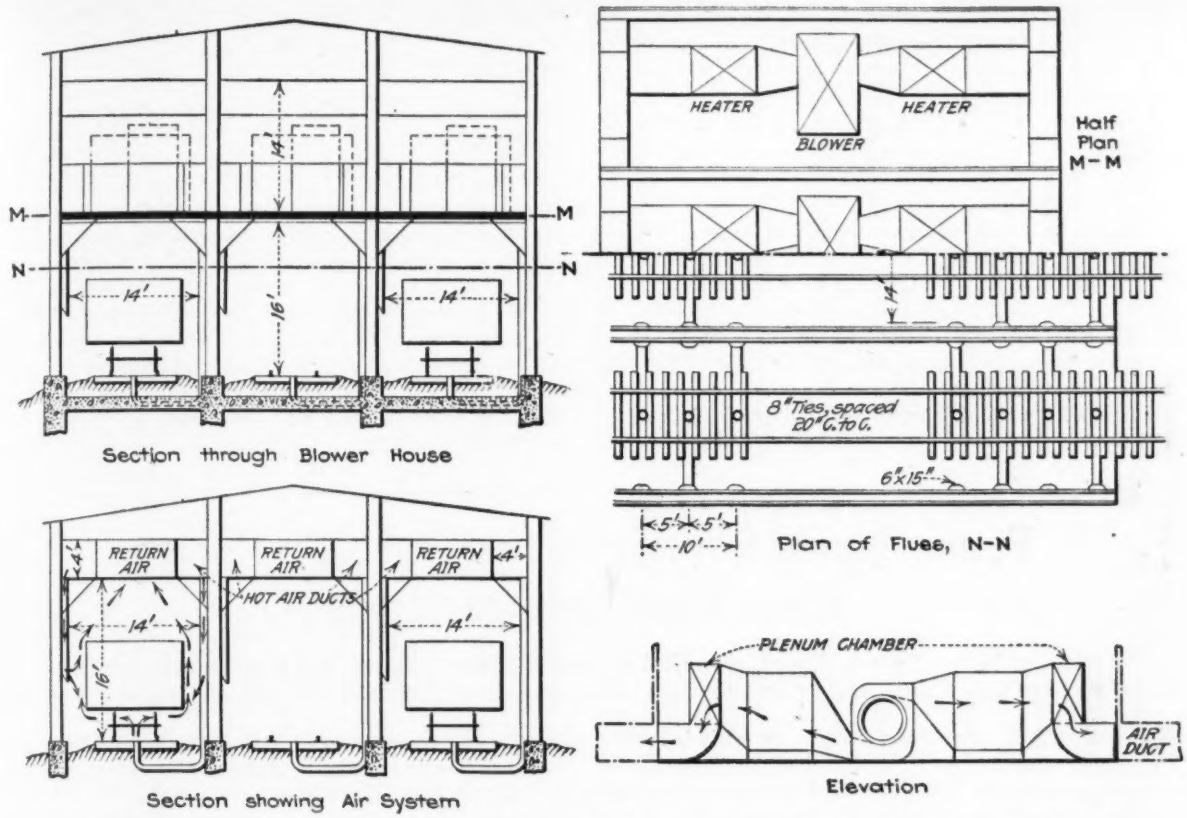
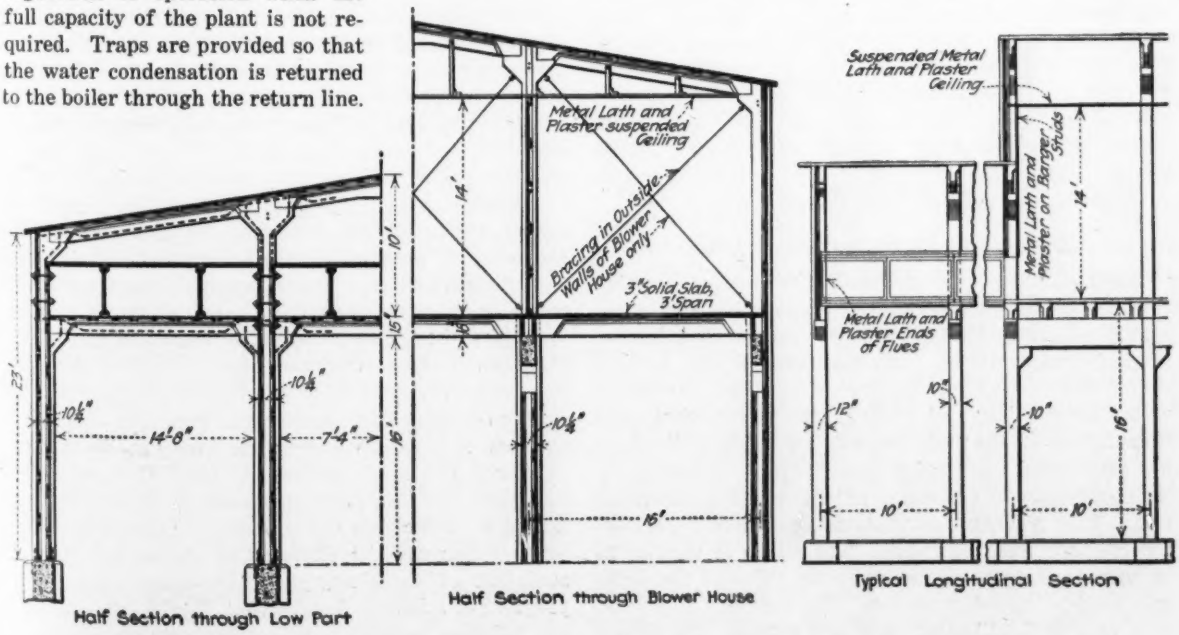


DIAGRAM TO SHOW HOW THE HOT AIR FROM THE BLOWER REACHES THE COAL CARS TO BE THAWED OUT

heater coils arranged one on each side of the blower and carrying sufficient pipe to insure delivery of the desired volume of air at the required temperature. The heater coils are provided with valves and other accessories necessary to divide them into groups for further regulation of operation when the full capacity of the plant is not required. Traps are provided so that the water condensation is returned to the boiler through the return line.

The hot air is handled by the so-called "blow through" system. Air is blown from the fan through heater coils into the plenum chamber, the bottom of which in this case is on approximately the same level as the bottom of the longitudinal distributing ducts lying just above


Metal Lath and Plaster suspended Ceiling
Bracing in Outside Walls of Blower House only
3" Solid Slab, 3' Span
Half Section through Low Part
Half Section through Blower House
Suspended Metal Lath and Plaster Ceiling
Metal Lath and Plaster on Ranger Studs
Metal Lath and Plaster Ends of Flues
Typical Longitudinal Section

COAL-THAWING PLANT AT SOUTH AMBOY, N. J., BUILT OF PRECAST REINFORCED-CONCRETE UNITS

the ceiling of the thawing room. In normal operation of the plant each blower unit provides hot air only to the room beneath the blower. However, the plenum chamber extends transversely across the full width of the blower room and is fitted with a system of dampers which can be adjusted so that air may be used in any room or in any combination of rooms with the operation of any blower unit.

Heated air enters the hot-air ducts which in this plant are two in number and lie adjacent to the wall and just above the ceiling of the thawing rooms. In the bottom of the hot-air ducts are openings connecting with the flues lying alongside of the wall and downward. Part of these discharge laterally toward the sides of the cars containing frozen material and the remainder are carried into flues opening upwardly toward the bottom of the car. This gives a good distribution of hot air coming in contact with the sides, the ends and the bottoms of the cars. It is often not necessary to thaw material all the way through and this arrangement of circulation thaws quickly where thawing is mostly required.

The return air duct lies between the hot-air ducts and extends to the ends of the building in the same manner. Openings are provided at intervals in the bottoms of the return air ducts and the cooled air returns thereby to the blower. Patents issued and pending covering the system of thawing material are held by the Walter S. Newhall Co.

Usually from one to two hours will thaw the ice in the coal so that it will dump freely when the car is turned over on the dumper. Under this system coal was thawed at an average of approximately 1.4c. per ton with the price of fuel coal obtainable up to the fall of 1916.

Pennsylvania Superior Court Decision Covers Moot Valuation Questions

Special-Use Value of Land, Reproduction Cost of Parallel Lines Absorbed, and Discounts on Securities Allowed in Ohio Valley Water Company Case—Engineers Best Fitted To Estimate Construction Period

VALUATION allowances frequently excluded were admitted by the Superior Court of Pennsylvania in a decision rendered Oct. 8, 1917. The case was the appeal of the Ohio Valley Water Co. from an order of the Pennsylvania Public Service Commission in fixing the value of the company's plant and establishing rates for water. Among the court's findings in reversing the commission's order is one that special adaptation for a particular use should be considered, and another that the reproduction cost of parallel lines absorbed should be allowed, even though the consolidation has rendered parts of the original plant useless. Going value, says the decision, must be allowed, and as a separate factor, considering the property as an entire operating concern. The cutting down of the estimated construction period by the commission is criticized, the court holding that the engineers were best fitted to determine this. Discounts on securities are allowed as a proper capital charge, and on the evidence 7½% is called reasonable.

Following are extracts from the decision:

Speculative Rates Not Permissible

Rates should not be speculative or put in operation for the purpose of determining whether too low or too high. Before that question can be answered, a loss of property might result. The business of rate making should not be an effort to impose on either the public or the corporation; and, while it may be true that some corporations in the past have acted unfairly to the public, that would not justify a confiscatory valuation by the commission or a lowering of rates causing a confiscation. Rate making contemplates fair dealing between the company and the public. The public is entitled to be served at reasonable rates on the value of the property used in the public service. The company is entitled to a rate that will allow it a fair return. To induce investment and the continuance of capital, there must be some gain commensurate with that of any other business. The mere assurance that the investment will not be confiscated will not suffice.

The weight of authority is in favor of the standard of present value as distinguished from the cost of reproduction or the actual cost of construction. Original cost, assuming that the books of the old concerns correctly recorded all of the items that went into cost, which would be quite rare, would not take into consideration many of the incidental features of expense which companies must meet, nor would it make any allowance for any "increase in value" in the physical property.

The present value represents more than the cost of reproduction, which is the present day cost of the real estate, machinery, equipment or plant, labor of installing or construction, and putting in place to perform its various functions. To these bare-bone charges must be added "time and money expended in the promotion of the enterprise; in the organization of the company and interesting capital therein, including, also, legal expenses, obtaining the necessary franchise, as well as the costs of incorporating the company"; engineering and superintendency; losses arising from accidents to men and material during the construction period; expenditures bound to be made by reason of the incompleteness of plans, always attached to the most perfectly planned work; the cost of administration, interest paid during construction; securing and retaining customers; the loss of earnings during the time usually required in a well managed, progressive plant to build up its business; the loss from unsuccessful experiments intended to protect life and property, or reduce operating cost, or increase the efficiency of the service; the installation of machinery made necessary through the progress of scientific development, thereby causing good but inferior machinery to become obsolete; increased public demands causing the present equipment to be-

come inadequate through lack of capacity and its replacement necessary; the cost usually attendant upon the consolidation of many plants into one efficient organization, the benefit of which should be reduced cost of operation and better service; and the increased value of such consolidated plants over the separate units that formerly composed them.

Special-Use Value of Land Allowed

The Neville Island property presents a difficult proposition. The appellant purchased several acres of land, upon which it drilled a number of wells, and secured a supply of pure water, which it pumped into its mains. The appellant contends that the particular value comes from the location of a sand bar within the property line, through which the water percolates into the wells, thereby enabling the appellant to furnish filtered water to its consumers. The appellees urge that inasmuch as some of this property is within the harbor lines, it is necessary for the appellant to secure a permit from the United States Government to sink its wells, which permit may be revoked at any time and the wells rendered useless.

This theory of the appellees to reduce the value of the appellant's property cannot be sustained. Considering the testimony as to what relative claims might arise between the Federal Government and the appellant as to the ownership or use of the land in question, the presumption of ownership is with the grantee, who is in the possession and use of the property. As against the entire world, its rights are, so far as the commission is concerned, free from dispute. It presents a title in fee simple, which, with possession and actual use, ought certainly to outweigh any remote possibility of danger from the Government, even if they could assert a right. If the appellant's title should be taken away at some future time, and its value should be of such weight as to enter materially into the basis on which the schedule of rates was fixed, the commission can readily adjust the rates; but until that time the appellant is entitled to what it bought, paid for, improved and is now using.

A special value is claimed for this property. The appellees would limit it to the price fixed for lots immediately adjoining, or in the vicinity; it is contended that water of the same quality as secured by appellant could be procured from the adjoining lots. The appellant is dealing with what has been done, and not with a problematical use of adjoining properties. It may be, as stated by Mr. Justice Hughes in the Minnesota rate cases, supra, that real estate should not receive an enhanced value beyond that of communal growth, and that the real estate of a railroad company should not be valued beyond that of contiguous properties or for its worth to the railroad; but that court, while disallowing condemnation value for real estate, was particular to say that real estate is entitled to a fair market value for all its available uses and purposes, or, if it has a peculiar value or special adaptation for a particular use, these items should be considered in the rate-making values.

There is a difference between increased value which accrues by reason of the concentration of population along the utility's line and the value which results from the centralizing of real property, mechanical appliances, machinery, equipment and business sagacity into a successful industry which produces large returns of the particular commodity which these energies were bent on bringing forth. For many years this property remained idle, when the men with the idea and capital developed it. Such property, so worked upon, has an added value undoubtedly beyond that of the mere cost of the machinery, the labor, and pay of the man who conceived the idea, or the value of the adjoining property or in the immediate vicinity. In this case the public has been benefited in that it is able to procure a commodity of purer quality in large quantities. If a fair rate-making value cannot be given this increased value, then much of the efforts of managers to procure satisfactory and suitable agencies to reduce the cost or better the service of utilities would be seriously handicapped.

Parallel Lines Not to Be Excluded

In considering the values of the parallel lines of the Monongahela Water Co. [which had been absorbed by the Ohio Valley Water Co.], the commission allowed one-third of the reproduction cost. The appellant asks that it be allowed full value for its parallel lines in McKees Rocks, and this, we think, is a proper request. If utility companies in organizing into one operating plant a number of smaller ones must be deprived of a fair return on the values of the properties purchased, and are also limited to the reduced cost of operation by reason of such consolidation, it is evident that the more practical way should be to permit the companies to remain separate operating concerns. The public is entitled to a fair benefit from every such move made by a utility concern; and where they assemble a number of plants with separate overhead and operating charges into one plant with one overhead charge and one or more operating plants, while the operating plant of some of the separate units may be rendered useless, still the new concern has paid for it, and the capital was originally and is now invested on its account. Investors could not be induced to traffic in such an unsatisfactory and unstable security, where the risk is not failure by reason of operation, but failure through confiscation. The benefit that should come to the public is through the reduced cost of operation; but the value of the dismantled plant should not be taken from the books as a capital charge until such time, through sale, or other equitable arrangement, such value has been reamortized. The reproduction cost should have been allowed as fixed by the engineers.

The commission declined to allow any sum for going-concern cost or value. While it is said due consideration would be given this item, its report expressly shows, in the separate items found, nothing was allowed for going value; in fact, the rate-making value allowed was less than the reproduction cost of the physical property. It will not do, as argued by the appellees, to say that the item of going value was considered in the reproduction cost as returned by the engineers for the appellees. Aside from the fact that the engineers by their evidence excluded any such thought, it would be almost impossible to determine the going cost or value assessable to each factor comprising the property. It is only by consid-

ering the property as an entire operating concern that we are able to reach any conclusion on this item.

The reason given by the appellees' engineers for not allowing any sum for going cost was that at the time the valuation was made the company had a paying business. This omits the theory upon which present value as aided by reproduction cost is found. It must include all the charges necessary to duplicate the plant, allowing present-day prices for the cost of construction. The present value, in the case before us, includes nothing for developmental, preliminary or going-concern costs or value as herein mentioned. As it is a property right, the commission cannot vaguely consider it; but where it exists as here shown, it must be allowed. While it may be said that the assessment of this value is difficult, still, as said before, difficulties will not justify confiscation.

Engineers Can Best Determine Construction Period

Interest during construction was allowed, but exception is taken to the reduced amount, for the reason that the estimated time within which the plant should have been completed was reduced by the commission. The experts for both sides, whose agreement on many items had been accepted by the commission, found that the time necessary to construct the plant would be two and one-half years. Those who have practical knowledge as to the time necessary to construct a plant of the magnitude of the one under consideration are properly qualified, and perhaps in a better position, to determine the time than lawyers or judges without practical experience. The engineers agreed that two and one-half years was a reasonable time; and this agreement should have been accepted, unless the commission had other information or other evidence from which to curtail that time.

Discount a Proper Capital Charge

Concerning the item of brokerage, the courts and commissions of other states have held that discounts on securities should be allowed; as utilities, like other companies, are not able to make their financial arrangements without allowing such discount. While corporations should not be permitted to capitalize their lack of credit, still, where bonds are sold at a reasonable discount and bear a fair rate of interest, such discount should be allowed.

What is a fair discount depends upon the condition of the money market and the ability of the organizers to attract capital to the project. When solicited to invest in a new project, with the uncertainty of success before him, the investor demands a return commensurate with the risk involved, and that must be something more than a legal-rate investment. If the venture is a failure, the investor is compelled to take his loss without any hope of recoupment; but it is equally unfair to require him to suffer all the loss if the enterprise fails, and to deprive him of the chance of additional gain if the venture is a successful one.

The company should be allowed the expense necessary to give a reasonable discount on bonds and (this has been the rule in the past), such discount should be allowed as a capital charge. To hold that only the cash received may be considered in a rate-making value would not only deprive the company of property, but would deprive the investor of property; it would drive from the field of legitimate banking the securities of hundreds of utility companies within the state. Many of these securities are held in good faith by banks throughout the commonwealth. We cannot view the present success of utility companies as the medium through which this question must be judged. It is necessary to go back to their formative period, when these securities were sold, and from that viewpoint examine the various critical stages through which the utility company has passed. It has only been through inventive genius that many utility concerns have become successful ventures. The appellant should be allowed a certain per cent. for brokerage or discount. The evidence before the commission was that 7½% of the reproduction cost would be a fair amount. This for a new concern does not seem unreasonable.

May Separate Road Construction and Grading

The Pennsylvania State Highway Department may let contracts for grading work separately from regular road construction next year, the department has announced. This subject is receiving serious consideration because of the advance in prices of materials, the difficulty in obtaining labor and the car-service interruptions caused by the priority order of the Government. The specifications are to be studied and taken up next month for determination.

Thus far only one or two contracts have been let for grading as a separate proposition, and observations have been made on them. In a number of instances county and borough authorities have favorably commented upon the plan for separate contracts.

Something like 26 counties have agreed to coöperate with the state in road work on a 50% basis, and 16 boroughs have accepted invitations to unite in improvement of streets which are on the line of state highways.

The department announced that hereafter it would make a charge of $2.50 for sets of plans and specifications for road work. Heretofore plans were to be seen at offices of engineers of the department. Under the new arrangement plans may be bought outright by interested persons and studied at their offices or homes. The announcement says that the price is at cost.

State Highway Commissioner O'Neil has rejected all of the bids received on Nov. 8 for road work which had been contemplated for Allegheny and Somerset Counties. The prices were considered so high that the department did not feel warranted in awarding contracts. All of this work will be readvertised in the near future. Bids were asked for either reinforced-concrete or bituminous-concrete construction.

England's War Taxes on Gasoline

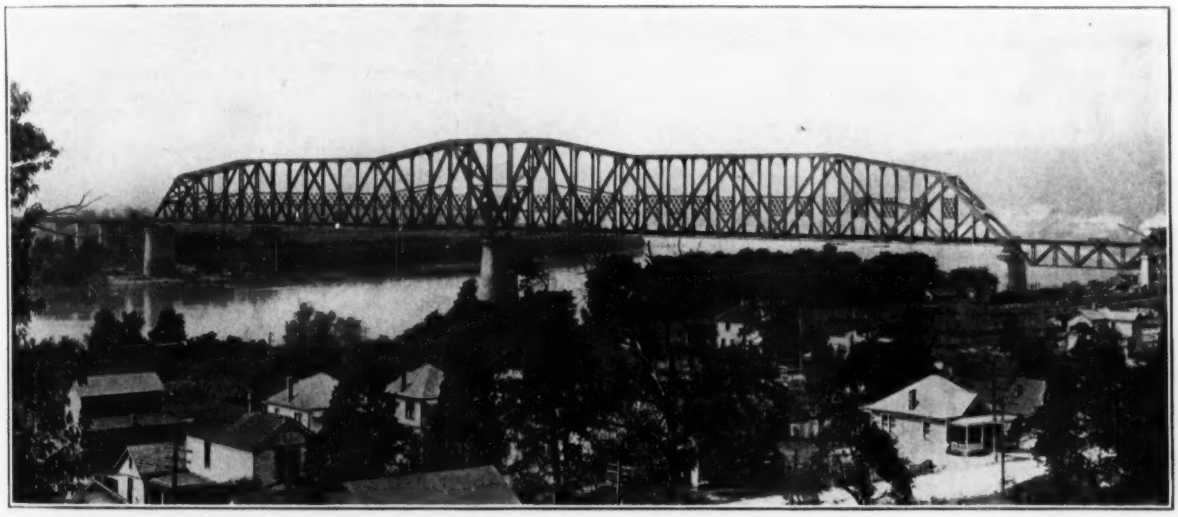
The tax which English authorities have placed on gasoline intended for use in motor vehicles has been raised to 25c. a gallon from 6c. a gallon, at which figure it stood before the war. Furthermore, and as an added restriction, no one is at present allowed to use gasoline for private purposes without an express permit from properly constituted authorities. Ten shillings, or $2.50, is no unusual price for gasoline.

Truss Erection and Jacking Operations for Two 775-Foot Continuous Spans

Second of Three Articles on Sciotoville Bridge Erection—Central Triangle of Heavy Members Set Difficult Task in Eliminating Secondaries—Methods of Forcing Joints—Deflection and End Lift Curves

By Clyde B. Pyle
Field Engineer for McClintic-Marshall Co., Pittsburgh

JOINING up the truss members of the Sciotoville Bridge in bent condition to eliminate secondary stresses in service—the distinctively new erection feature of this structure—required different methods in the Ohio and the Kentucky spans, as the former was erected on falsework, while the latter was cantilevered out from the middle pier. How the rivet holes in the connections were laid out to the strained shape of the trusses was described in *Engineering News-Record* of Jan. 10, 1918, pp. 62 to 68, in outlining the general procedure of the erection and the equipment used; in the field these connections had to be brought together by forcing, which involved extensive use of jacks, as described in the present article. Heavy jacking was required also to swing the spans, their continuity making the structure of indeterminate or constrained type. The information obtained through this jacking throws much light on the practical value of continuous bridges.



SCIOTOVILLE BRIDGE—THE FAR SPAN, CROSSING THE LOW-WATER CHANNEL ALONG THE KENTUCKY BANK, WAS ERECTED BY THE CANTILEVER METHOD

As shown diagrammatically in Fig. 1, truss erection was started at the middle pier. This was done because: 1. It started the work at a fixed bearing (both end bearings have expansion rockers); 2. Constructing the two spans simultaneously, connected over the center pier, allowed the cantilevered Kentucky span to relieve the load of the Ohio span on its falsework, and made the progress of erection more rapid; 3. Erection of the middle four panels was greatly simplified, and the forces required for bending the members to connection were reduced; 4. The safety of the work was increased in relieving the falsework in the middle of the river first.

The plan of simultaneous erection was abandoned, however, after only one panel of the Kentucky cantilever had been placed. Approach of the season of cold weather and high water made it advisable to complete the Ohio span as rapidly as possible, so that it would be free from at least all the timber falsework should there be a heavy run of ice. The shortage of men and the impracticability of handling material for both travelers on two tracks were factors in the decision.

To start truss erection at the middle pier, the following procedure was adopted: The first four towers of timber falsework (at 1, 2, 3 and 4 Ohio) were erected to provide space for setting up the gantry traveler. The traveler, erected on these towers to 60-ft. height, placed the timber and steel falsework for the Ohio span and set the bridge floor on it while proceeding toward the middle pier. It also set the bearing shoes on the middle pier and laid down upon them the lower chord of the two panels 18-20 K. Then, moving back toward the Ohio end, it placed all the lower chord of the Ohio span.

Before any truss erection was started, the splices between the two-panel lengths of the lower chord were completely riveted while the chord was level and straight. Since the truss members had been fabricated to such lengths as to make the chord straight under full live load on one track of the bridge, the method of riveting described eliminated secondary stresses from the chord. While the riveting went on, the gantry traveler was raised to full height, 150 ft., and the light subposts and hangers were erected with the derrick car. The opera-

tions so far are represented in diagrams *A* to *C* of Fig. 1.

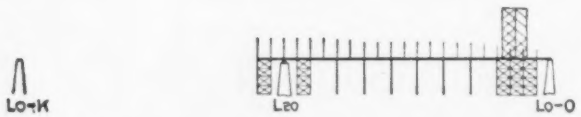
The steps required in the specially difficult problem of erecting the middle four panels are indicated diagrammatically in Fig. 4. For every practical method of procedure in erecting the four panels, extensive computations had been made to determine the position of each member, the amount that the holes would be out of match at every point, and the forces required to bring the holes true.

Owing to the comparatively large changes in length of these members for camber, and the fact that the main members were so stiff that driftpins would not bring the holes to match, the problem was to erect in such an order and in such manner that the holes would match when the member was first put in place. This was accomplished in simple and economical manner, the striking erection features of the method being as follows:

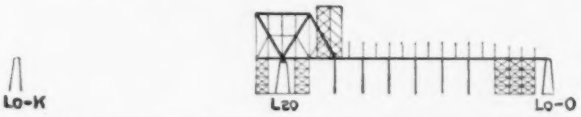
The lower chord was jacked into a decided curve (See Stage II, Fig. 4), with both L18 points 1¼ in. higher than L20, by wedge jacks supported on the timber falsework at 18K. Two 200-ton jacks (as shown in Fig. 9 of the preceding article, *Engineering News-Record* of Jan. 10, 1918, p. 64), were used, since the total load to come on this point was about 600,000 lb. They were operated by a ratchet with 6-ft. handles pulled by a 2-in. runner line of the traveler. This jacking brought the unreamed holes in the subhangers at both L19 points ⅜ in. above the holes of the chord, but the holes came fair with the completion of the trusses and the simultaneous straightening of the lower chord.

A—Gantry raised to 60-ft. height on timber falsework.

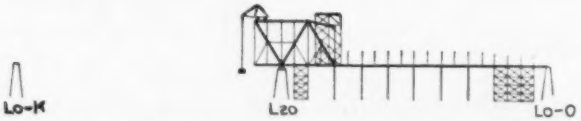
B—Falsework and floor erected to 18K; floor 6 in. toward Ohio end.



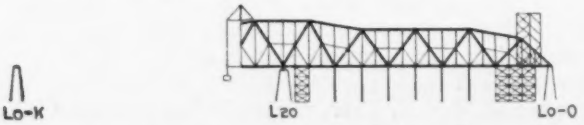
C—Chord erected to Ohio end, splices riveted when level and straight. Floor moved 6 in. to final position. Gantry raised to 150-ft. final height. Chord jacked to initial curve.



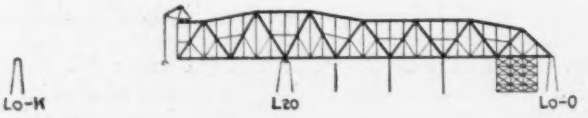
D—Middle four panels completed; timber towers at 18K and 19K released. Ohio span supported on steel tower at panel-point 16.



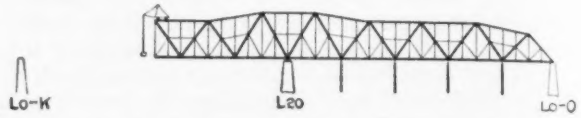
E—Truss completed to 16 Ohio. Creeper traveler erected on top chord. Towers at 18K and 19K removed.



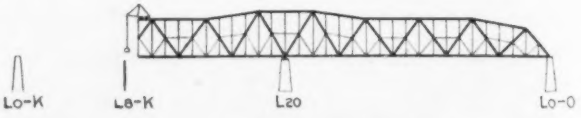
F—One panel of cantilever erected. Ohio span erected complete on falsework; Ohio end 8¼ in. low.



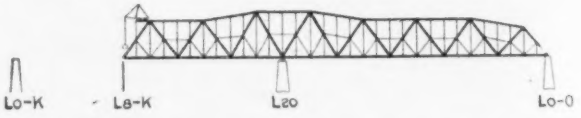
G—Gantry traveler taken down; Kentucky cantilever continued; timber falsework removed, starting at middle pier; load released from steel tower at 16 Ohio.



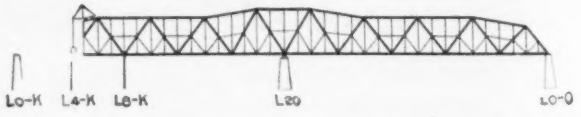
H—Kentucky cantilever erected to 10K; Ohio span swung by jacking end 8¼ in. up and placing permanent rockers.



I—Cantilever erected to panel-point 9K; steel tower erected at 8K by creeper traveler.



J—Erection continued to 8K and truss jacked up on tower.



K—Erection continued, and second steel tower erected at 4K.

L—Cantilever extended to 4K and jacked up on tower there.

M—Bridge erected complete. Kentucky end 16 in. low. Kentucky span swung by jacking end 16 in. up, placing permanent rockers; steel falsework towers at 4 and 8K removed and creeper dismantled.

FIG 1. SCIOTOVILLE BRIDGE ERECTION PROCEDURE SUMMARIZED BY DIAGRAMS OF THIRTEEN STAGES

When the upper ends of the diagonals M19 U18 were placed (Stages II and IV, Fig. 4) the holes in the diagonal at U18 were 1¼ in. above those in the vertical at that point. These members were held in the falls until rivets enough were driven in the outer rows of holes at M19 to take care of the bending moment at those points when the diagonals were slacked to make the holes in the posts at U18. The delay was about two days in each of these cases. A decided curve was visible in the long diagonals after the upper ends were lowered to connect.

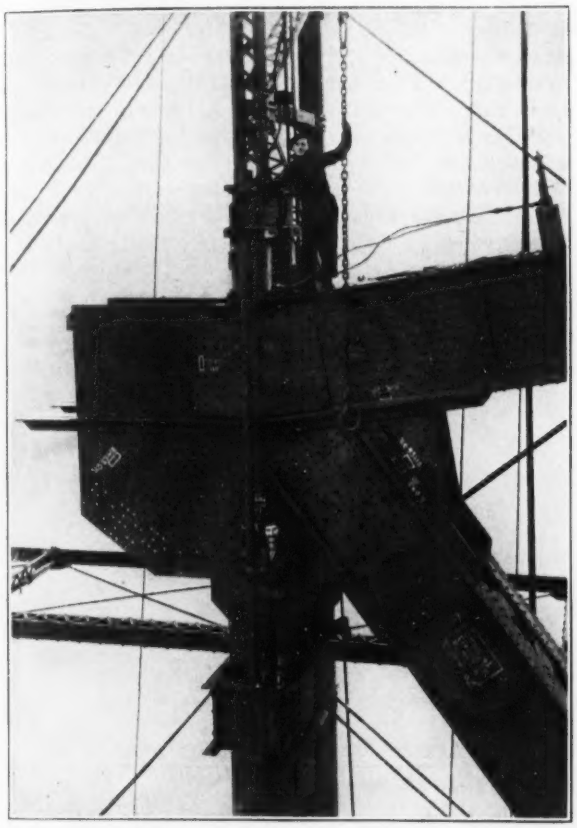


FIG. 2. FORCING THE HANGER AT U14K TO CONNECTION WITH TOP CHORD BY SPECIAL JACKING-YOKE

When the top chords U18 U20 were set (see stages III and V, Fig. 4), the U20 ends were held on 2-in. shims until sufficient rivets were driven in the outer rows of the main diagonal and chord at U18 to take care of the bending moment at that point when the chord was slacked to contact with the posts at U19 and U20. This involved practically no loss of time; while the Kentucky top chord was being riveted, the gantry was moved and some members of the adjacent panels on the Ohio side of L20 were set, and while the Ohio chord was being riveted the bracing was erected. After both U18 points were riveted, the 2-in. shims were removed and the chord was lowered to contact with the posts at U19 and U20. But now the two chords were ¾ in. apart at U20 and were not tangent (Stage VI, Fig. 4).

In order to close the ¾-in. gap two large turnbuckles were placed across and turned with long crowbars (Stage VII, Fig. 4). The vertical at L18 U18 O was cut loose from the gusset at U18 O, and the load falls nearest U18 O on the top chord were given a good strain. This closed the gap at U20, but made another gap at U18, and still left the chords not tangent at U20. To bring them tangent, the U19 posts were bolted to the chords, the U20 ends raised (singly, on account of the large force required), and ¾-in. shims were placed under the chords at U20. With these shims in place sufficient of the outer rows of holes in the U20 splice were riveted to take care of the bending moment that would occur at U20 upon removing the ¾-in. shims. To remove these shims the U19 bolts were loosened and the falls at U20 given a strong pull.

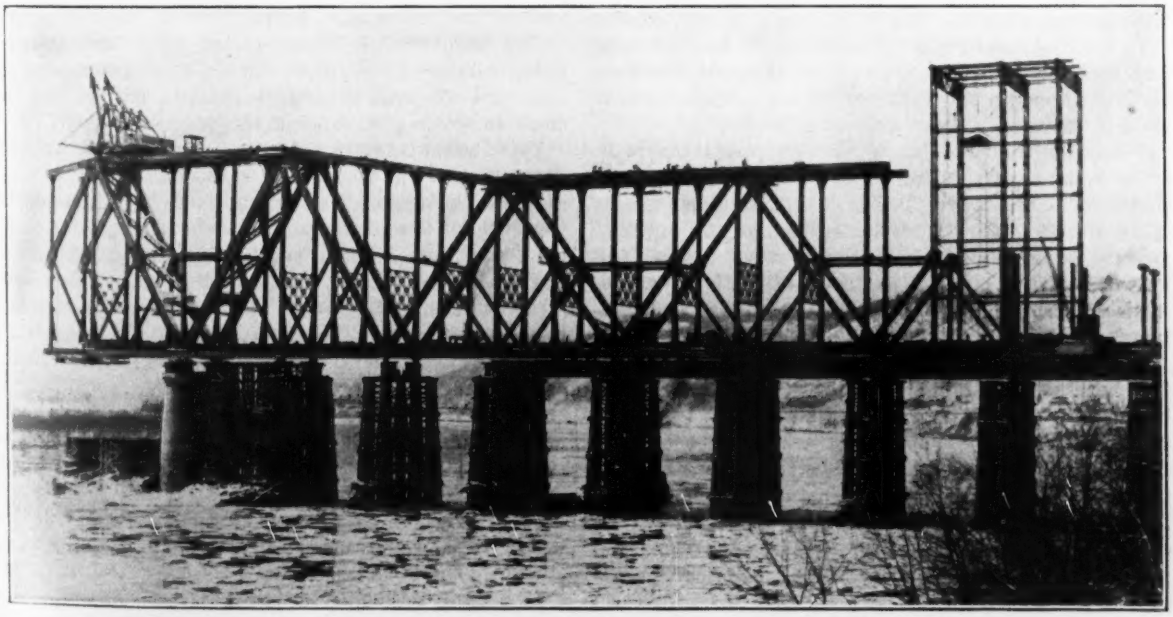


FIG. 3. IN ERECTING THE OHIO SPAN THE WOODEN TOWERS AT INTERMEDIATE PANEL-POINTS WERE RELEASED AS EARLY AS POSSIBLE TO REDUCE DANGER FROM ICE IN FLOOD TIME

Computation had been made and a jacking device built for closing the ¼-in. gap at U18; the force required was 304,000 lb. But, because L18 U18 was much lighter than the members of the main triangle L20 U18 O U18 K, the post lengthened much more rapidly than the main members when the sun first shone upon the structure in the morning, and it was found that the gap closed and the rivets could be driven without any jacking.

When the four panels were riveted complete the top chord at U20 was not in contact with the post by ¼ in. (Stage VIII, Fig. 4). This gap closed as erection of the trusses proceeded and the chords became more nearly straight.

The middle four panels formed a unit that was almost balanced on the middle pier. The load was therefore released from the timber tower at L18 K by slacking the wedge jacks at that point, keeping them just in contact with the chord for the sake of stability.

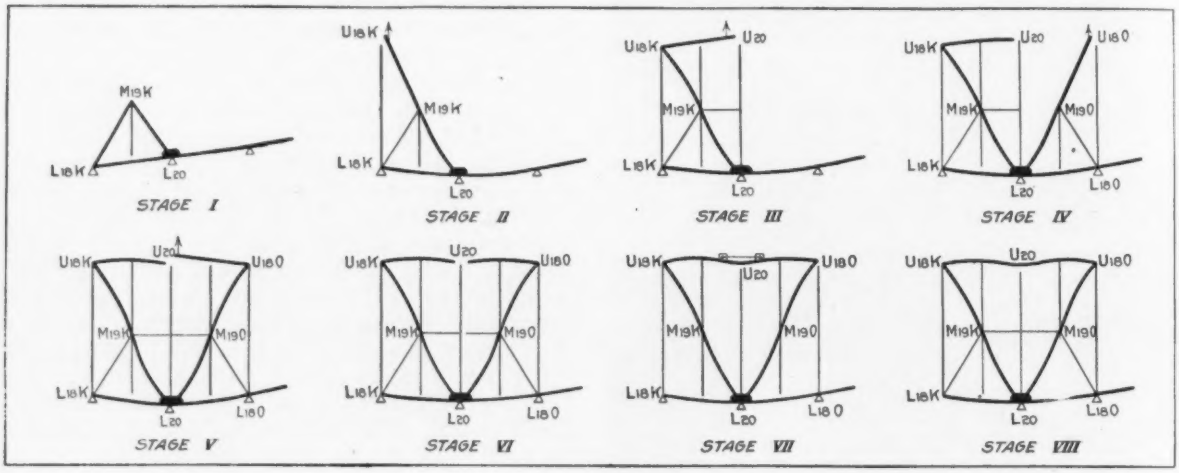


FIG. 4. ORDER OF PROCEDURE TO CONNECT THE HEAVY MEMBERS OF THE CENTRAL TRIANGLE IN THE DESIRED DISTORTED SHAPE

In the diagram of Fig. 4, curves are shown for main members only, as the light members were not the cause of any concern; a few driftpins in their joints brought good holes in every case without difficulty.

When the middle triangle was completed the main truss system was erected to 16 O, where it was supported on a steel tower (D, Fig. 1). The timber towers at 18 and 19 O were not released, but on the contrary the wedge jacks at those points were raised to put a full load on each one; in this way some of the load was released from the steel tower at 16 O, merely as a precaution, not as a necessity.

At this time the creeper traveler was erected on the top chord between U20 and U18 K (E, Fig. 1). It was intended to erect about one Kentucky panel for every two panels of the Ohio span. But when only one panel, 18-17 K, had been erected, the shortage of men and the proximity of winter, with attending danger to falsework from ice, led to the decision to push the Ohio span to completion, postponing work on the Kentucky span. The ice danger also led to removing the timber falsework as rapidly as the truss erection permitted, since the steel towers at 4, 8, 12 and 16 were more than sufficient to carry the weight of the Ohio span. With 150-ft. openings thus left between steel towers, the ice would be unlikely to jam and cause trouble.

As already mentioned, the bottom chord was freed of secondary stresses by riveting its splices while it was straight and level. Its curves before truss erection was started and after the Ohio span was erected are shown at the top of Fig. 6. It being the original intention to erect the Ohio and Kentucky spans simultaneously and to take only the unbalanced load on the steel towers, the lower chord after splice riveting and before truss erection was jacked to such a curve that the truss members would connect to it without further jacking. This curve was very close to the no-load camber curve of the truss, so that almost equal loads would come on the steel towers when the Ohio truss was completed. Very little jacking was necessary as the erection proceeded. Point L16 was purposely left lower than the no-load camber curve to relieve the lighter steel tower at that point, and reduce the tension in U14 U18 O.

The Ohio trusses being erected on falsework to a heavy camber curve there was an easy opportunity to raise the free end of each two-panel length of the top chord to obtain good holes at the connecting end.

From panel-point 18 to 4, the four diagonals sloping down toward the Ohio end were straight when connected. The diagonals sloping up from 16, 12, 8 and 4 O were held at the middle points by the horizontal struts; the struts were of such lengths as to bring good holes at the lower ends and to hold the diagonals straight when the upper sections were connected to the top chords. The upper parts of the same diagonals were well pinned and bolted to the lower sections, as they had to hang free while the top chords were being erected. When these diagonals were pulled up to connect to the top chords with the falls (shown in Fig. 17, p. 67, Jan. 10) the long verticals did not make holes with the top-chord gusset plates. These holes were brought to match by raising the bottom chord with the wedge jacks, which operation put slight bends in the diagonals and top chords.

In placing the end post in one piece and connecting the lower end first, the camber of the lower chord held the U2 end of the batter post about 1½ in. too high for

good holes. Bolts and 30 or 40 driftpins served to bring the holes to match.

The Ohio span alone did not become self-supporting until the Kentucky cantilever was completed to about 15K. At about this stage the U14 U18 top chord of the Ohio span became the critical or highest-stressed member, owing to the cantilever load and to the 1,000,000-lb. reaction still on the steel tower at L16 O. The load on the steel tower was therefore released by placing four 200-ton hydraulic jacks under either truss and removing some of the shims. The releasing of this load lowered the chord only $\frac{5}{16}$ in. at L16 O.

During the Kentucky cantilever erection it was necessary to rivet the horizontal struts such as M15 M17 in order to make a complete truss system on which to carry the creeper traveler. When the main truss system of the next panel of the bridge was connected the subhorizontal was no longer needed. One end of one of the struts was cut loose and left resting on shelf angles at the time of jacking the vertical to good holes at points such as U14; this jacking relieved the stress in the horizontal strut and allowed the rivets to be cut out. Leaving the struts connected would have put redundant members in the bridge. The jacking device used to connect simultaneously the long subhangers and disconnect the horizontal struts is shown in Fig. 2, a small reproduction of the cover picture of the Dec. 13, 1917, issue of *Engineering News-Record*. It consisted of two yokes, two 3½-in. special-steel rods and two 200-ton hydraulic jacks.

When the Kentucky cantilever was completed to 10K (Stage H, Fig. 1) the Ohio span was swung. The Ohio end was raised 8¼ in. by jacking under the end floorbeam (See views Fig. 5). The nest of 20-in. I-beams on the pier rested on a cushion of roofing paper; on the beams was placed a bolster which accommodated a 500-ton jack in the center and brought four 200-ton jacks to the level of the larger jack. A special casting was used to transfer the jacking force to the floorbeam.

Increments to the jacking load were comparatively large—200 tons per inch—until the truss was raised free from the tower at 4 O. The lift-load curve is given in the right half of Fig. 8. As there shown, the increments decreased as the span lifted off its successive supports. Tower 8 went free just before the end was high enough to place the 16-in. rockers under the shoes. In order to free the tower at 12, the end was jacked 4 in. above the height required for the rockers. The original scheme of erection provided for Tower 12 being taken out before this stage, but jacking the extra 4 in. was a simple means of removing it at this time.

During the jacking the lift was followed up with shims (Fig. 5) of ½-in. steel plates, the same number being kept under both trusses. When there was sufficient space the shim plates were removed and rockers from the 150-ft. deck span substituted; with the plates a foot or more high, several inches of the jacking would be lost in slacking the jacks, as had to be done for placing shims on top of the jacks.

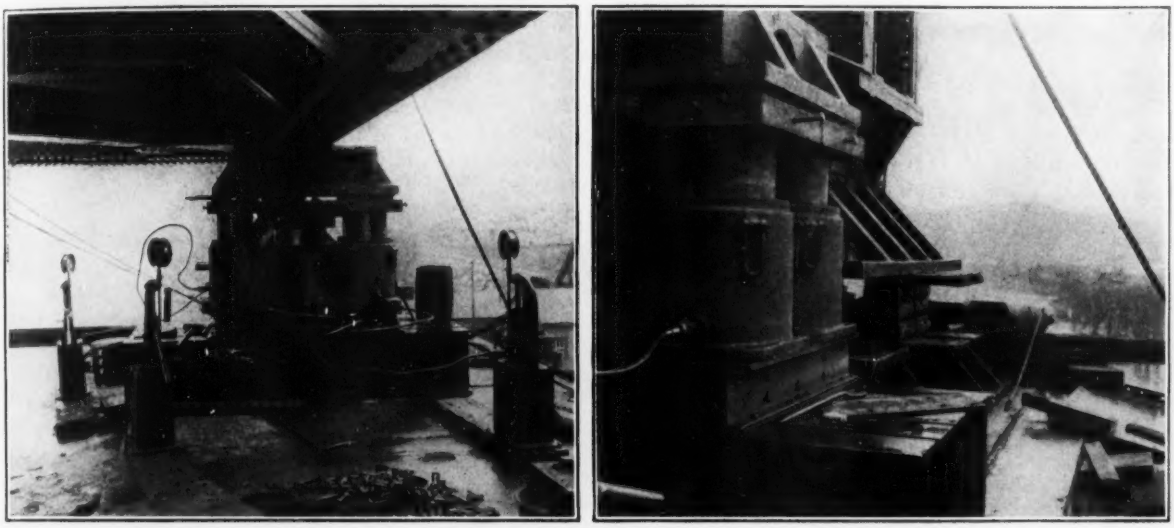


FIG. 5. JACKING THE OHIO END OF THE BRIDGE; SHIMS UNDER SHOE TO HEIGHT OF 16 INCHES

The jacking time for raising about 12 in. and lowering 4 in. totaled seven hours for 24 men. Another day was consumed in setting up and removing the jacking rigging, setting the shoes accurately and placing the rockers. During the jacking the lower chord stretched 1¼ in. The deflection curve for Ohio span swung and Kentucky cantilever completed to 9 is shown in Fig. 6.

In placing the bottom-chord sections, the splice at the rear end of each section was made before connecting the web members. The splice joint was held in perfect match by resting the front end of the chord section on jacks on the flying bridge of the creeper traveler. This eliminated bottom-chord secondaries.

The diagonals sloping down toward the Kentucky end between 18 and 4 went in place practically straight, and had good holes at the end when only a few pins were driven. The diagonals sloping up from 16, 12, and 4 K were held at the middle points by the horizontal struts. These struts were of such a length as to make the diagonal holes match those of the bottom-chord gusset plates. The upper parts of these diagonals connected with good holes to the top chords, and the diagonals were straight when connections were made. However, in some of the top-chord splices a few driftpins had to be driven before the splice came into match, as the outer ends of these chord sections were held a trifle too high by the posts.

At U14, 10, 6 and 2K the vertical hangers were too low to connect. The jacking device shown in Fig. 2 was used in these four cases, the two trusses being jacked simultaneously.

With respect to setting the batter post, the same conditions existed as at the Ohio end.

Keeping the bottom chord of the cantilever in line was a rather difficult matter, partly because the downstream lower chord was shielded from the sun in the morning. The expansion of the upstream chord at times moved the end of the cantilever 2½ in. downstream from a straight line. Haze often obscured both backsights and foresights. The center-line marks on several floorbeams were clearly visible at the same time from the instrument set up under the center floorbeam. Each center-line mark toward the end of the cantilever was off center a little more than the preceding one. In setting a section of chord, the floorbeam, with center line marked on its bottom flange, was placed between the chords of the two trusses. It was then set downstream from the mark on the floorbeam set just previously by an amount a little greater than the distance between that mark and the preceding one. On hazy days the center-line marks were used as foresights, and on cloudy days the center-line marks were found to be truly on line.

When the bridge was landed on Tower 8 K it was downstream about 1½ in., from the effect of the sun. It was easily brought to line with two 50-ton Norton jacks placed in the temporary shoes immediately under the chords.

To bring the free end of the bottom chord to correct level, an instrument could not be used conveniently, as the chord already in place was curved. It was sighted by eye and a check taken on it by examining the holes in the chord splice. The free end of the chord

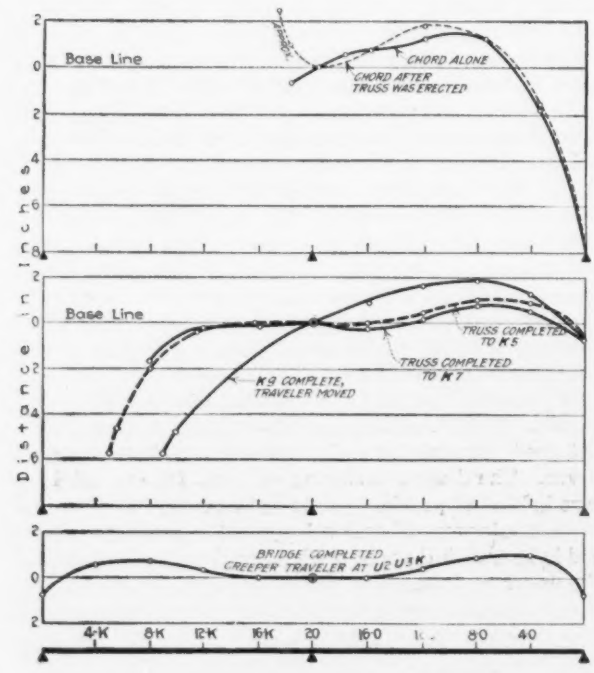


FIG. 6. DEFLECTION CURVES AT DIFFERENT ERECTION STAGES

was raised or lowered by two 50-ton Norton jacks on the flying bridge suspended from the creeper traveler.

When the cantilever was completed to 9 K, the steel tower formerly used at 12 O was taken across the river and erected at 8 K by the creeper. The truss was then extended to 8 to rest on the tower (I and J, Fig. 1).

Upon reaching the steel tower at 8 K the intention was to measure the deflection of the free end of the cantilever before jacking at that point, in order to compare actual with computed results and determine better the proper distance to raise the end of the cantilever. Instead, the following procedure was followed: Shims were put on top of the shoes on the columns, of such thickness that when the bottom-chord sections were entered at L9 and supported on the shims good holes would result at L9. The L9 splice was well pinned and bolted, so that when the diagonal L8 M9 was brought to L9 on the trucks the deflection from its weight would be resisted by the bending of the lower chord. The shims made the free end of the chord about ¼ in. too high for good holes for the diagonal, but a few driftpins easily made good holes and left the end of the truss supported on the steel tower (View C, Fig. 7).

In order to determine what the deflection at 8 would have been if unsupported, that point was raised by the hydraulic jacks and corresponding distances and loads plotted for five positions. The truss was jacked up twice, readings taken for jacking up and slacking down, and the average of the four sets of readings used. The actual deflection would have been 8.62 in.; that computed without considering the effect of truss details was 9.14 in., and that computed with allowance of 20% for the effect of details 6.35 inches.

The truss was raised 7⅞ in. with a force of 462,000 lb. per truss (±25 tons for probable error). The computed jacking height was 7.9 in. when no allowance was made for truss details, and 6.52 in. when 20% allowance was made, the load in both cases being 430,000 lb. per truss. This jacking reduced the stress in U14 U18 K so that its capacity would not be exceeded during the erection of the rest of the bridge.

Erection of the trusses was continued to 5 K (K, Fig. 1, and View D, Fig. 7), and thereupon the second steel tower was placed at 4 K. The lower part of the truss was completed in the same way as at 8 K, but the deflection was read with the truss unsupported. The actual jacking height was 1 in. with a force of 384,000 ± 50,000 lb. per truss. The computed jacking was 1.42 in. with a force of 470,000 lb. (no allowance for details) or 1.02 in. for 425,000 lb. (20% allowance). Results indicated that a 10% allowance for truss details would be correct.

Erection was now completed to the end of the bridge. The view opposite shows the bridge completed to 2 K. The bottom-chord section L0 L1 K was landed on 200-ton wedge jacks on the pier. Therefore no accurate reading of the deflection of that point hanging free was obtained, but 16 in. to 16½ in. is probably what it would have been.

The same jacking outfit as shown in Fig. 5 was used under the Kentucky end floorbeam. Curves of actual and anticipated jacking are given in Fig. 8. As shown, the actual jacking corresponded very closely to the computed values for 10% allowance for truss details. An

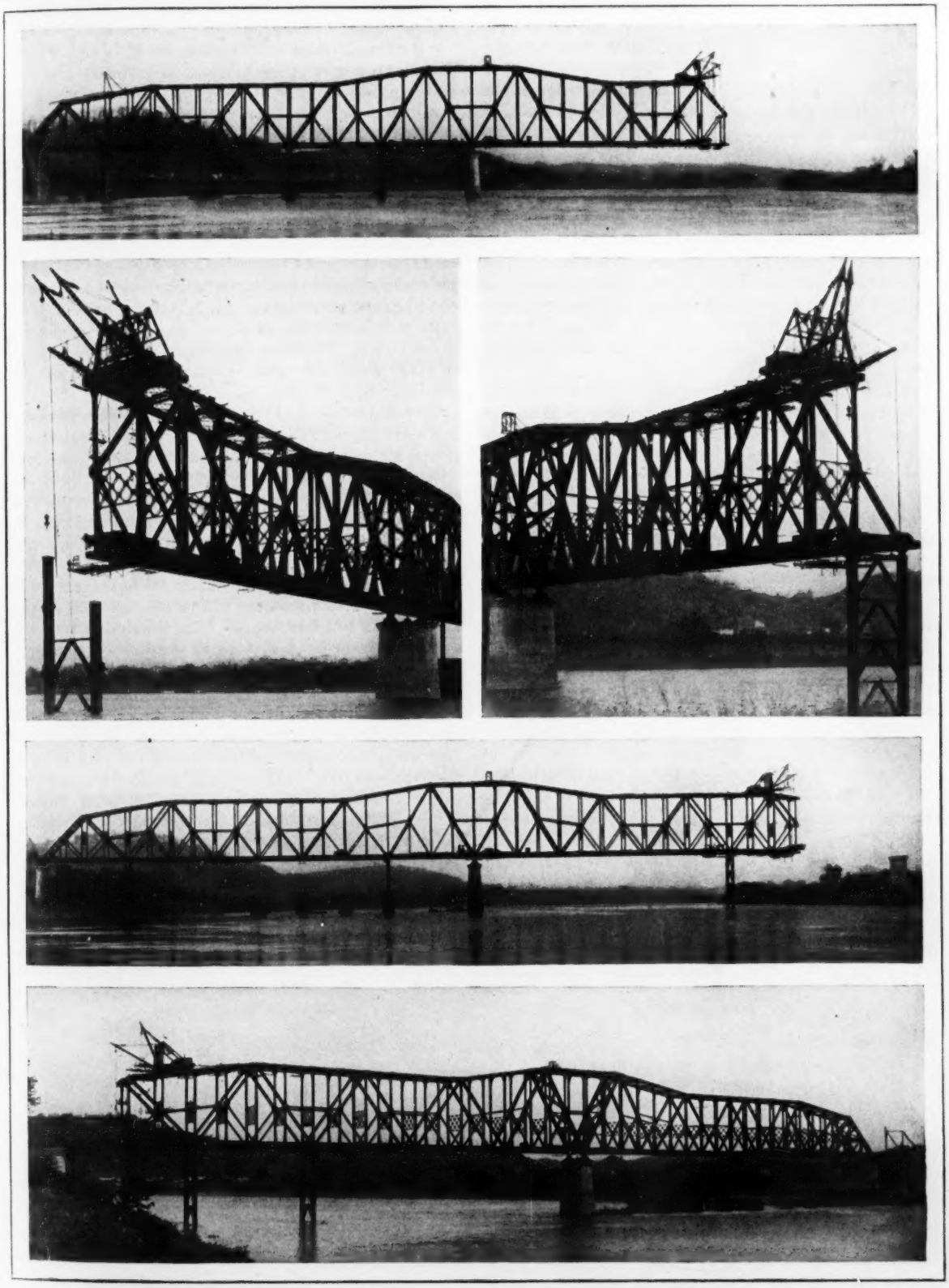


FIG. 7. TWO BENTS SET ON TEMPORARY PIERS IN THE KENTUCKY CHANNEL SHORTENED THE CANTILEVER OVERHANG TO 465 FEET

A—Erection to panel-point 9 completed Apr. 13, 1917. B—Six days later, creeper at 9 sets steel bent. C—Bridge resting on completed bent at point 8. D—May 9, nearing the location of the second bent. E—Bent at point 4 in service May 23, 1917. Two panels still to be erected.

allowance of 4% for friction was made from the start to the stage when the tower at 8 was freed, because the jacking was continuous for all except the first few inches.

During the jacking the bottom chord stretched 1¼ in. The lateral force which this stretching brought to bear on the jacks was sufficient to slide the nest of I-beams on the pier. Between the nest and pier was ½ in. of roofing paper, which was softened by the warm weather.

The curve of the bottom chord of the bridge after L0 K was jacked and before the creeper was removed from U2 U3 K is given in Fig. 6.

One of the most striking features of the entire erection was the curve for the last few inches of the jacking after the steel towers were both free. The computed increment to the load for each inch of lift was 7½ tons. The actual increase in load was too small to be read on the gages.

It is quite evident from this condition that for long-span continuous trusses it is not as vital a point as was formerly thought to be the case to have the supports at exactly correct elevations. In this case an error in setting one of the end supports, say as much as 3 in., would have changed the end reaction 22.5 tons, or the stress in the end post 32 tons, which would be less than the probable error in computing the actual stress in that member. The worst conditions of shop work, erection and setting shoes could not possibly total more than 1 in., so that the certainty of stresses and therefore the safety of such a bridge is left without question.

The fact that complications enter into the design and erection cannot bar the use of such bridges as long as they are economical. The reasons usually given, that the stresses are not statically determinate and that uncertainties of stresses result from slight errors in elevation of the supports, are no longer valid.

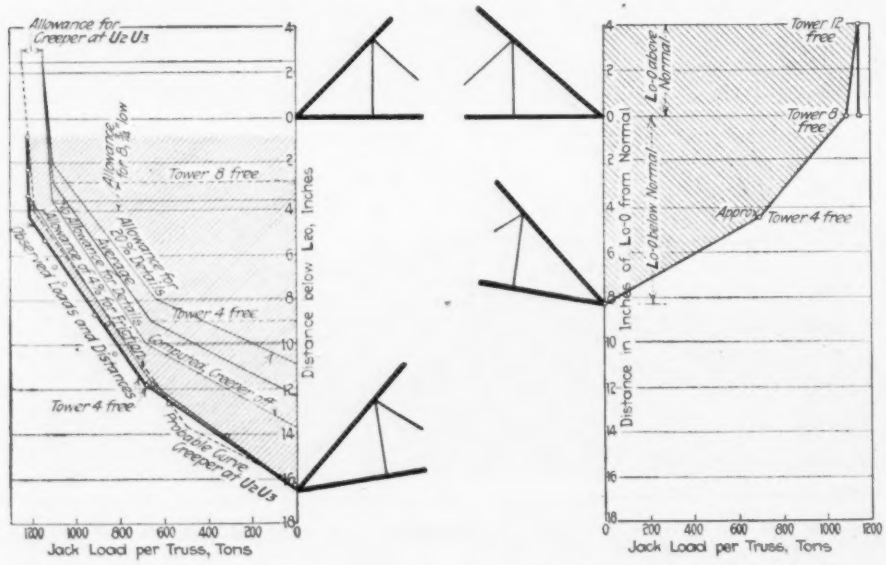
Throughout the cantilever erection the riveting in each panel was practically completed before starting erection of the next panel. This, although it appeared at first, from a superficial standpoint, to be a loss of time, was in reality a saving of time. To have moved ahead with the erection would have necessitated driving a great many driftpins more than for simply fitting up for riveting, and under stress it would have been very difficult to remove these. Since the riveting could not have lagged more than a few panels behind the erection, the most rapid completion of the bridge was accomplished by the least work. Under the conditions, scaffolds were hung from the creeper to the correct position for riveting top and bottom-chord splices and bottom lateral bracing.

In addition to completing the bridge more rapidly, this method greatly reduced the cost of riveting. The safety of the entire work was also increased greatly—a very important factor, since bridgemen are in general afraid of cantilever work. In this case, probably 100 or more quit before the cantilever was landed on the steel tower at 8 K. The apparent safety was of as much importance as actual safety, because it was so difficult to obtain or to hold men.

Several thousand 1¼-in. rivets were driven, some having a grip up to 9¾ in. It was very difficult to get good rivets, owing to the large number of thicknesses of steel with every surface heavily coated with red lead. Although the joints were well bolted, the paint would melt and burn out to such an extent that in some joints half the rivets would be loose. The air pressure was raised to 135 lb. per sq.in., as lower pressures did not always bring the head into solid contact with the plate. No accurate records were kept of the relative costs of 1-in., 1⅛-in. and 1¼-in. rivets, but it became clear that sizes over 1 in. should be avoided if possible on account of their very high cost.

A most remarkable feature of the erection was the fact that actual results corresponded so closely with the computed values. Curves of members, location of the free ends, forces required to connect the free ends, deflections, jacking distances and loads, were computed under the direction of P. L. Wolfel, chief engineer of the McClintic-Marshall Co., for the entire bridge. In only three cases did the openings at the free ends vary more than a few per cent. from those computed. These cases were the connection of the diagonal L4 M3 O to the horizontal strut M4 M3, the connection of the long hanger at U14 K, and the connection at U2 K. These differences were due probably to changes made in the method of erection, and to having raised L8 and L4 K less than was intended.

The curve of the lower chord of the Ohio span was computed so that every member connecting to it would have holes matching without further jacking. The holes matched as desired except at two points, and the jacking of these points was negligible.


Allowance for Creeper at U2 U3
Tower 8 free
Tower 4 free
Tower 4 free
Distance below Lo, Inches
Jack Load per Truss, Tons
Tower 12 free
Tower 8 free
Approx. Tower 4 free
Lo-0 above Normal
Lo-0 below Normal
Distance in Inches of Lo-0 from Normal
Jack Load per Truss, Tons

KENTUCKY END JACKING OHIO END JACKING

FIG. 8. CURVES SHOWING LIFT AND LOAD WHILE JACKING UP ENDS

The middle four panels presented a most difficult problem of computation on account of the severe and complex curves of heavy members. In some cases the effect of tension and compression in several of the light members had to be considered. In every point of erection of the middle four panels the actual results were exactly as computed.

In cases involving the deflection or jacking of the bridge as a whole, such as L8 K, L4 K and L0 K, the actual results corresponded exactly with the computed, as already stated.

These results go to show that for a bridge of this type an allowance of about 10% for details is practically correct. It is advisable, however, to make computation for no allowance and for 20% allowance for details; the actual results should fall between the two.

Special mention was made in the preceding article of those having responsible relations to the work.

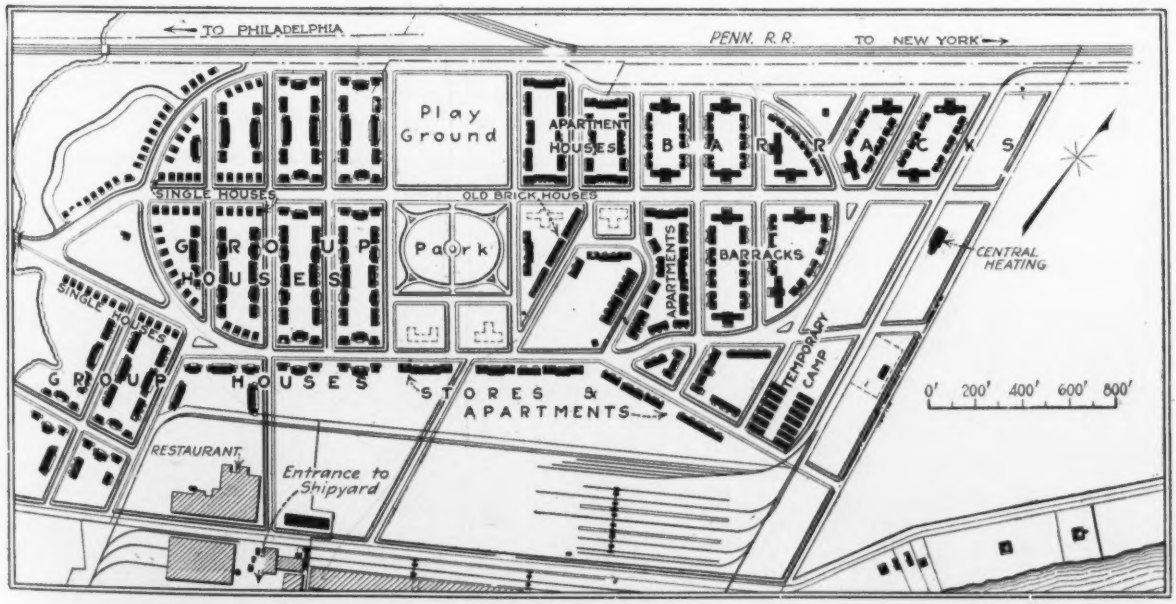
Building a Town To House Three Thousand Shipbuilders

Group of Bachelor Quarters in Workmen's City at Government Subsidized Plant Nearly Complete and Work Starting on Accommodations for Family Men

AT BRISTOL, Penn., along the shores of that 50-mile stretch of the Delaware River which will soon be the busiest shipbuilding center in the world, the much-discussed Government industrial housing program is beginning to take its first tangible form. Here on ground that six months ago was farmland are rising the houses and apartments which will help make up the village where are to live a large proportion of the workers in the plant of the Merchants Shipbuilding Corporation, the agent of the United States Shipping Board which is building fabricated steel ships at this place.

Bristol, the only town at all convenient to the plant, was so obviously inadequate to house all the 6000 workmen required that the Government authorities set about laying out an industrial town simultaneously with designing the yard itself. When the site was taken over last summer, work was immediately started on the first group of these houses and the contractor had to complete in about six weeks quarters to accommodate some 1800 men. Part of these houses were made structurally complete but were finished in the rough and immediately put in use as temporary cantonments or barracks for the men building the plant. The remaining groups were finished complete, inside and outside, and are about ready for their permanent occupants the shipbuilders. A further appropriation just available makes possible the immediate extension of the development to all the types of houses proposed. When this work is completed in the early spring the town will be in a fair way toward a realization of the complete plan laid out by the housing experts of the Shipping Board.

This plan contemplates the building from the beginning of a complete town to house 3000 workmen with their families, a community of 6000 people. This means more than the mere construction of buildings where people can live. It means the application of the best ideas in industrial housing and town planning as held in the United States today. For the present, at least, the designers were not restricted by any consideration of future operations, considerations which govern a large part of most industrial housing schemes. They were, indeed, restricted in the amount of money which they could appropriate, but they did not have to worry about the returns on their investment, the methods of operating or continuing the ownership of the houses. All



INDUSTRIAL TOWN LAID OUT BY U. S. SHIPPING BOARD FOR THE WORKERS OF THE MERCHANTS SHIPBUILDING CORPORATION AT BRISTOL, PENN.

of that remains for a future time. What they did have to do was to lay out in an absolutely open area a town site where not only structure and capacity should be considered, but where the amenities of life should be preserved.

The town is located in a comparatively flat, open and slightly wooded area between the shipyard and the four-track main line of the Pennsylvania R.R. This site, about 2400 ft. long and 1200 ft. wide, is divided up into city blocks approximately 350 x 650 ft. with main streets 70 ft. wide and cross streets 50 ft. wide. Variation from the rectangular layout is had by curved streets at each end, and two diagonal streets in the middle to tie into a set of old brick houses, which were part of a cast-iron pipe foundry located here at one time. All streets lead either directly or by easy turns to the main entrance to the shipyard and, as the farthest house is only about 3000 ft. from that entrance, no workman need take more than ten minutes to walk from his home to the yard.

The houses are separated into groups to suit different needs. These groups are (1) barracks or camp blocks where single men boarding at special restaurants are housed; (2) apartment houses, to accommodate small families; (3) group houses, that is small complete two-story houses joined together by common walls into one structure and (4) single houses. Generally speaking, these groups are in separated sections of the town, though the single houses and the group houses are interspersed. There will be, in addition, along the main longitudinal street stores with apartments overhead, and for the time being there is a temporary camp at the extreme east end of the town, where are housed the laborers engaged in construction work on the yard. Just what provision will be made for permanently housing this sort of labor has not been entirely decided, but it is hoped that the temporary camp will be done away with soon after the shipyard is in operation. There are then to be about 1800 men in barracks, 1000 persons in the 500 apartments, 1500 in the 500 group houses, and 400 in the 100 single houses. The remaining 3000 men in the shipbuilding plant will be housed in barracks, in boats beside the wharf at the yard, and in boarding houses in and around Bristol.

The camp units or barracks located at the extreme northerly end of the town are in seven blocks of the same general type, varying only according to the curvature or angularity of the streets on which they front. The typical block comprises three camp units on each long side of the block with a so-called hotel or boarding house unit on each end. One larger block has four camp units on the side, and some of the curved blocks, as shown in the drawings, vary still further. A unit in each block is composed of two six-room one-story houses joined together by a corridor. Each half has five bedrooms, accommodating ten men, and a central living hall, while the connecting corridor is given over to the toilet facilities. Each hotel or boarding house has a dining room and a kitchen, and accommodations for sixty men, sleeping two men to a room. A normal block will take care of 240 men, 120 in the units and 120 in the hotels. All of these men will get their meals at the hotel dining rooms; that is, 120 at each end of the block. Decision has not yet been made as to the method of running the dining rooms, but it is hoped that there will be separate control of each hotel or boarding house, thereby establishing a desirable competitive interest in the running of the mess. A large restaurant at the southerly end of the town, near the entrance to the yard, is also being built. This, however, will take care of the meals of the men while they are at work, and is not expected to interfere with the operation of the village hotels and boarding houses.

Each barracks block has a fair size playground in the interior. The streets inside this section will not be paved, but will be provided with a sidewalk and lawn. There should be no need of vehicular traffic in these side streets.

The apartment house group, which is next to be built and of which four rough finished units are in use now as cantonments, consists of units of two-family houses grouped together, the architectural treatment of the groups being unified. These are two stories high with separate apartments of from two to four rooms on each floor. A group consists of from four to six apartments, and each apartment has a kitchen, dining room, one or more bedrooms and a bath. Of the 500 of such apartments, 200 are included in the next erection program, including the finishing off of the groups which have been built in rough form.

SOME OF THE BACHELOR QUARTERS BLOCKS NEARING COMPLETION. EACH BLOCK HAS BUNKHOUSES

The group houses are two-story structures, each house having from four to six rooms and the groups from two to seven houses. Special attention has been paid to the exterior treatment so as to avoid the separate-house idea so often emphasized in the ordinary two-family house development. The architecture of each apartment group has been unified, so that the group is treated as a single structure of the better suburban house type. Of the 500 of these planned, 40 are included in the next program.

For those who can afford it, single houses with from four to six rooms and bath, with separate plots of land, are provided. Thirty of these are to be built in the immediate program.

All of these apartments and houses have ground in the rear where the resident may have his own garden or garage, and all are set back a fair distance from the streets. The streets are to be paved with some permanent paving and concrete sidewalks are provided throughout the development. It is hoped also that a planting scheme will early be put into effect. It will be noticed that in the center of the town there are large open spaces. One of these is a park, the other a playground for the children, and in others will be located the communal buildings; that is, the churches, community house, library, etc., all of which it is the intention of the Shipping Board to build soon, though not in the immediate program.

The town is served with water from the Bristol water supply and is connected with sewers to the city's sewer system. Electric lighting is connected to every house, and while central heating will take care of the barracks group, a few of the apartment houses, all of the group houses and single houses are to have individual furnaces.

All of the houses built so far are of wood frame with various kinds of exterior treatment. Some are finished in stucco, some with shingles, and some with clapboards. It is expected that in the new program some brick and hollow tile will be used. Every house, however, has a fireproof roof. While the interior lay-out of each type is the same, the exterior appearance of the several houses of a type is kept as different as possible by various architectural devices, such as changes in slopes of the roofs, the direction of the roof slab, and the painting scheme. Partitions in the barracks units are of composition board, but in the rest of the buildings plaster walls are used throughout, and in addition separate apartments or houses in one unit are separated by firewalls of hollow tile from cellar to roof. The town also has three fire houses for additional protection against conflagration.

The construction of the first group of houses was controlled by the necessity for speed. The contractor, Fred T. Ley & Co., who not only has the contract for the housing scheme but also for the buildings in the shipyard itself, did not have the opportunity to make as careful arrangements as to method of construction as it has since developed for the remaining houses. In consequence some of the details of construction will be changed in the new work. However, in the essential element—time—the contractor was eminently successful. Work started on the first group of houses on Oct. 20. In three weeks this group was turned over to the workmen as living quarters. The final group of the complete houses was started on Nov. 6 and was ready for the plumbing. There are now complete thirty-six of the unfinished barracks houses and hotels, twenty-four of the finished structures of this type, and four unfinished apartment houses. The unfinished buildings are completed structurally, as noted before, but have few interior partitions and are covered only with a building paper. The houses are being used for the roughest kind of bunk quarters.

On beginning the job the first thing the contractor had to do was to excavate the cellars and trenches. Little grading was required in this section of the site, although there was considerable steam-shovel work near the shipbuilding yard. The streets, however, were practically on grade, and it was possible to begin trenching right away. These trenches were all dug with a steam-driven Keystone excavator, which proved remarkably efficient in this type of work. There were four sets of trenches in some streets; one for water, one for storm sewers, one for sanitary sewers and one for the heating pipes. In the later development some of these pipe lines will, of course, be consolidated in single trenches. No out of the ordinary methods were used in placing the service pipes, except possibly in the heating pipe line, which was placed inside of half-round terra cotta pipes laid on cradles. These pipes were in half-rounds and

WITH ROOM IN EACH FOR TWENTY MEN, AND TWO HOTELS AT THE ENDS OF THE BLOCK

LOOKING OVER ONE OF THE STREETS BETWEEN TWO BACHELOR QUARTERS BLOCKS

after the heating pipe was inserted in the terra-cotta section an upper half-round was placed over it and the whole filled up to grade.

The bunkhouses have no cellars. All the excavation done was in the wall footings, which were excavated by hand. Cellars under the hotel buildings were dug with the Keystone excavator and the spoil placed near by, afterward being removed when required. The wall excavation was followed closely by the concrete walls for the buildings. For this concrete slag aggregate was used and the concrete was mixed in small portable mixers which were wheeled around to place as required. Proceeding then in order came the carpenters, and finally the plasterers, plumbers and painters.

In the organization there was a foreman on each house, who had complete charge of the construction there. Over these foremen were two carpenter foremen who divided the work about evenly, and a district mason foreman who had charge of all the masonry work. House gangs were matched against one another with considerable success. About 1200 men were employed in the construction of this group of buildings.

All lumber was cut in the yard and brought to the houses as needed by motor trucks. Motor trucks also were used in getting all the other materials to the site. There was not, however, a sufficient storage yard to guarantee a reservoir of material. This has been remedied in the new design. A large storage yard and house are being built, which will be filled up beyond the immediate needs of the individual houses to be erected. This undoubtedly will expedite the work.

The streets will not be taken care of until late spring, after the frost has come out of the ground. The contractors are anticipating considerable difficulty with the mud at that time.

The layout of the industrial town at Bristol has been carried out by the Merchant Shipbuilding Corporation to the plan provided by P. R. MacNeille of New York, consulting architect of the United States Shipping Board. The Fred T. Ley Co., New York and Springfield, Mass., as stated, is carrying on all the building operations under Superintendent R. C. Studely and Chief Engineer R. W. Clark.

Panama Canal To Have Laboratory To Study Paint for Tropics

Expenditures for paint materials by the Isthmian Canal Commission having reached $255,366 in 1915 and $229,463 in 1916, a special laboratory is being installed in the office building of the water purification plant at Miraflores to make a special study of formulas and methods of application of paint, and to determine the best processes of protecting wood and metals under tropical circumstances. George C. Bunker, who has charge of water purification at Balboa Heights, will direct the laboratory.

Though there are five paint-grinding machines at the Balboa shops for general canal needs, and one at Pedro Miguel Locks which does work for all locks, the problem of painting has never been solved for the peculiar conditions that affect work of this sort in the Canal Zone.

Although special steel plates coated with protective mixtures made according to various formulas are exposed at present at the lower end of the Miraflores locks, the determination of the most effective protection is now to be made the subject of special study.

TWO SETS OF FIVE BEDROOMS AND LIVING ROOM CONNECTED BY TOILET-ROOM CORRIDOR IN EACH HOUSE

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Should Engineering Students Be Drafted?

Sir—In your issue of Dec. 27, 1917, p. 1211, appeared a letter "Should Engineering Students Be Drafted?" from F. J. MacIsaac. To my mind this was grossly unjust and I feel that something should be said on the students' side of the question.

At present I am a fourth-year civil-engineering student at the Municipal University, Akron, Ohio. I am of draft age but have not as yet entered the service of my country. I believe, however, that I am as red-blooded an American citizen as you will find in or out of the service, and I am also egotistical enough to believe that I would not be entirely useless if drafted into the service.

Mr. MacIsaac's letter has caused a great deal of discussion among the students here at school. I don't believe that there would be a doubt left in Mr. MacIsaac's mind as to the patriotism of the helpless, slacker class now attending the various engineering schools throughout the country if he would only visit a few schools and voice opinions such as his published one.

Engineering students in our American technical schools have responded nobly to the call to the colors. The ranks have been depleted but there are patriotic men left who now are called unpatriotic and helpless. In justice to these men let these few remarks be printed. Men all over the country are smarting under the unjust indictment, and I feel I am voicing the sentiments of not a few loyal, patriotic Americans who are still enrolled in the ranks of technical students.

I hope that you will give me the pleasure of seeing this sentiment in print, and I sincerely trust that one Mr. MacIsaac will read what one engineering student thinks. J. S. KENNEDY.

Akron, Ohio.

Jacoby's Equation Is Not Rational

Sir—Mr. Fee's letter in the issue of Jan. 3, page 48, is quite right in suggesting that Jacoby's equation for the determination of the allowable pressures on cuts of timbers applies only to pressures of liquids (and of gases), as it does not take into account the variations in the properties of solid bodies of transmitting pressures in different directions. Neglecting the properties of solids in this respect, the problem can be reduced to one of the equilibrium of a triangular prism subject to external pressure, which gives the usual static equations. However, when the author makes $P' = s'dy$ and $P'' = s''dx$ with s' and s'' the allowable unit stresses, one is apt to think that he is after dy and dx, or, which is the same, the angle θ corresponding to these unit stresses. This makes it somewhat confusing from the start, for s' and s'' as used are not the allowable unit stresses, but the unit stresses corresponding to P' and P'' acting along dy and dx, since P, P' and P'' form the system of forces which is in equilibrium. The author may have had two thoughts in mind: the development of the allowable unit stresses s' and s'' and the determination of the corresponding cut in accordance therewith.

However, the variation of the smoothness of the bearing surfaces of cuts, according to the way in which they have been made, makes the matter less important. Besides, with the low unit stresses usually allowed in timbers on account of their variation in texture, one is likely to obtain a satisfactory s with the ordinary methods of framing. Yet it would be at least of theoretical interest to know a little more about the ultimate value of s. E. R. T. BERGGREN.

New York City.

Questionable Practices in Engineering Work

Sir—In *Engineering News-Record* of Nov. 1, p. 825, under the heading "Professional Questions," you print some comments by D. R. Shearer, the following among them:

"There is one questionable practice which seems to be growing upon the profession in recent years and about which little is heard in the journals and societies. That is the selling on commission of certain machinery or equipment by engineers who are supposed to represent their clients in an impartial and unprejudiced manner. Of course, there are many sales engineers who often are called in as consultants, but in such cases the clients know what they are doing. The trouble comes from the engineer engaged in general practice who has surreptitious agreements with manufacturers and of course recommends the products of these manufacturers without carefully weighing the advantages of equipment made by other manufacturers of similar lines."

It is evident that Mr. Shearer did not sufficiently consider the possible interpretation of his words by a layman who might read them, when he characterized so mildly the crime which he describes, and said it "seems to be growing upon the profession." The writer is sure that Mr. Shearer's views, if expressed more adequately, would be in accord with those of the writer and of the entire profession.

Engineering societies and journals are of *engineers* and for *engineers* and have little time or space to devote to a class of unpunished criminals who call themselves engineers but are not recognized by the profession. There are honorable men who are sales engineers and who very properly act as consultants at times, their clients knowing their other alliances. The class of men who pose as consulting engineers and have "surreptitious agreements" for their own profit at the expense of their clients are bribe-takers. This is the mildest name applicable to them. They cannot comprehend the first principle of a profession with the high ideals held by engineers. They are not engineers.

The crime which Mr. Shearer describes is not "growing upon the profession." A. L. DABNEY.

Memphis, Tenn.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Prepare Illinois Highway Engineers for Road Bond Issue

The recent meeting of highway officials of Illinois, which preceded the short course in highway engineering given at the State University at Urbana, was attended by seventy county and state road officials. Besides considering administrative problems the meeting gave out much information as to the $60,000,000 bond issue for a 4 mile statewide road system which will be voted on at the 1918 fall election. The State Highway Department is making every effort to place in the hands of all road officials full information concerning the mehtod of raising and administering this money so that it may be used in propaganda favorable to the passage of the issue.

Governor Lowden addressed the gathering and laid especial stress upon the fact that the outcome of the election would be affected by the success with which the people were informed that the money would be raised by a tax on automobiles. Furthermore, he asserted, the people should be convinced that the roads would be built strictly in accordance with the highest engineering principles. Addresses were given by H. E. Bilger, road engineer for the department; B. H. Piepmeier, maintenance engineer, and Clifford Older, chief highway engineer.

Missouri Road Department Meets With Road Builders

During the convention of the American Association of Road Builders which will be held in St. Louis, Feb. 4 to 7, inclusive, the Missouri State Highway Board will hold a meeting of county highway officials and others who are connected in any way with the state system of roads. This will be the inaugural of what is intended to be an annual event.

In connection with the convention and meeting of state highway officials, a testing laboratory will be maintained for the purposes of testing samples of rock or gravel which may be brought in by various county officials. The services will be rendered gratis, and the person bringing in the sample will be allowed to witness the test if he desires. It is expected that by this means much valuable information regarding the state's resources in road-building material will be gathered.

St. Louis May Adopt Zoning Plan

A districting or zoning system for St. Louis is being worked up by the City Plan Commission, of which Harold Bartholomew is engineer.

Appointed Colonel of Engineering Regiment

COL. FREDERICK MEARS

Close Specifications Held Legal by High New Jersey Court

In upholding the award of a contract for paving in Montclair, N. J., the Supreme Court of the state recently ruled that a specification which was drawn up for Warrenite exclusively was legal, inasmuch as the manufacturers had filed a certificate stipulating the price at which the material could be purchased by any bidder.

In the first instance the contract was awarded to the Standard Bitulithic Co., although it was not the lowest bidder. This award was subsequently set aside and bids were readvertised, Warrenite being specified. On the second bidding the Standard Bitulithic Co. was the low bidder and the contract was awarded to it. This second award was attacked on the ground that the contract did not specify the time within which the work was to be completed, and that the specifications required the use of a patented road material.

Examinations for Teachers in New York Evening Schools

Announcement has been made by the Department of Education of the City of New York of examinations of eligible applicants to teach in the evening schools the following subjects: Concrete construction work, mechanical drawing, plan reading and estimating, shop mathematics, structural engineering and surveying. Applicants for appointment must file at the office of the board of examiners, Park Ave. and East 59th St., New York City, not later than Feb. 15, an application made out on the regular form to be had on request. With this application, candidates are required to file evidence sufficient to establish eligibility. Eligibility to teach any of the subjects named may be established by showing four years' successful experience as a wage-earner in the vocation, but there are other alternative conditions of eligibility which the board of examiners will supply on request. Candidates will be notified when to appear for examination.

Commission Is Appointed To Study Railroad Wage Problems

Franklin K. Lane, Secretary of the Interior; C. C. McChord, member of the Interstate Commerce Commission; J. H. Covington, chief justice of the Supreme Court of the District of Columbis, and W. R. Willcox, formerly chairman of the New York Public Service Commission, Second District, constitute a commission created by the Director General of Railroads to investigate railroad wages in the United States.

The investigation is to cover the whole field of railroad labor—the compensation of persons in the service of the railroads, the relation of railroad wages to wages in other industries, the conditions in different parts of the country, the special emergency respecting pay which exists at this time owing to war conditions and the high cost of living, and the relation between different classes of railroad labor.

The creation of this commission, says the *Official Bulletin*, is the culmination of a large number of complaints and demands of employees pending before the railroad managers for some time, and brought to the attention of the Director General shortly after Government assumption of railroad operation. It was stated that these complaints came in all forms, from various classes of railroad labor organizations and from groups of unorganized employees.

For Promoting Industrial Education

The eleventh annual convention of the National Society for the Promotion of Industrial Education will be held in Philadelphia, Feb. 21-23. The main topics for discussion will be "Vocational Education In War Time"; "Administration of the Smith-Hughes Act"; "Twentieth Century Vocational Training" and "Reorganization of the National Society."

Draftsmen Wanted by Naval Ordnance Bureau

The Bureau of Ordnance, Navy Department, is in need of competent draftsmen. Men who are graduates in mechanical engineering from a technical school or college of recognized standing and have had some drafting-room experience, or men who are competent designers of heavy machinery, engines or shop tools, and have had a number of years drafting-room experience, are eligible for these positions. The pay ranges from $4 to $6.88 per day, depending upon the qualifications of the draftsman. It is announced that there are at present a number of vacancies in the rating of draftsman at the Washington Navy Yard. Additional information may be had by addressing the Commandant and Superintendent, Naval Gun Factory, Navy Yard, Washington, D. C.

Department of Labor Forms Public Service Reserve

On Monday, Jan. 28, the Department of Labor will begin the recruiting of an army of 250,000 men, from which will be filled all present and future labor needs of the shipbuilding yards of the United States. In this work the Council of National Defense, the Shipping Board, the governors of the various states, organized labor and business will lend aid, while 20,000 "Four-Minute Men" will urge the necessity of the action.

The drive for recruits will extend from coast to coast, and will endeavor to enlist all labor which has to do in any way with the construction of ships.

The U. S. Employment Service will control the work directly and will try to keep all men at their present tasks until they are called to specific jobs. According to the Department of Labor, this action will eliminate the demoralization that has attended the competition for labor in recent months. A rational apportionment will give the country the maximum benefit to be derived from labor, and will do much to avert the hardships that have attended the shifting resulting from the old competition for the services of skilled workers.

Thacher's Patent Appeal Lost

On Jan. 19, 1918, the United States Circuit Court of Appeals, in St. Louis, Mo., upheld the lower-court decision against the well-known Thacher reinforced-concrete bridge patent (No. 617615), rendered by Judge Martin J. Wade on Sept. 12, 1916. This case (235 Fed. 724) was a suit brought by Edwin Thacher against the authorities of Polk County, Iowa, for the infringement of his patent. The case was defended by the Department of Justice of the State of Iowa. Judge Wade dismissed the plaintiff's bill in a decision reported in *Engineering News* of Sept. 28, 1916, p. 621, and *Engineering Record* of Sept. 30, 1916, p. 423.

Contractors Who Are Now Engaged on Construction Work Under the Cantonment Division, Q. M. G. O.

Fort Leavenworth U. S. Disciplinary Barracks	R. B. Yoakum, Fort Leavenworth, Kan.
Port Newark Terminal	McArthur Brothers, Newark, N. J.
Animal Quarantine Depot, Baltimore, Md.	J. B. Watson Co., Baltimore, Md.
Extension of General Hospital No. 1, New York City	William Crawford, Williamsbridge, New York City.
Curtis Bay Ordnance Depot	Smith, Hauser & MacIsaac, So. Baltimore, Md.
Raritan River Ordnance Depot	Snare & Triest, Metuchen, N. J.
Pig Point Ordnance Depot, Pig Point, Va.	James Stewart & Co., Norfolk, Va.
Baltimore Depot Warehouses, Baltimore, Md.	Sanford & Brooks Co., 9th to 11th Sts., Baltimore, Md.
Addition to Animal Embarkation Depot, Newport News, Va.	Westinghouse Church Kerr Co., Newport, Va.
Fort McHenry Hospital, Fort McHenry, Md.	J. Henry Miller, Inc., Fort McHenry Hospital, Baltimore, Md.
Fort Worth Experimental Station, Fort Worth, Texas	Bryce Building Co., Experimental Signal Station, Fort Worth, Texas.
For' Des Moines Hospital, Iowa	Charles Weitz Sons, Fort Des Moines, Iowa.
Philadelphia Q.M. Expeditionary Storage Depot	William Steele & Sons Co., 4th and Walnut Sts., Philadelphia, Penn.
Chicago Q.M. Interior Storage Depot	Central Mfg. District, Chicago, Ill., 39th St and Ashland Ave., Chicago, Ill.
St. Louis Q.M. Interior Storage Depot	Westlake Construction Co., 2nd and Arsenal Sts., St. Louis, Mo.
Pittsburgh Q.M. Interior Storage Depot	The Austin Company, 4th and Butler Sts., Pittsburgh, Penn.
Addition to Coast Artillery Post, Pensacola, Fla.	Hugger Bros., Montgomery, Ala.
Addition to Coast Artillery Post, Galveston, Texas	Horton & Horton, Houston, Tex.
Addition to Coast Artillery Post, Boston, Mass.	I. F. Woodbury Sons Co., Boston, Mass.
Addition to Coast Artillery Post, Mobile, Ala.	Jetts-Muths Construction Co., Inc., Mobile, Ala.
Addition to Coast Artillery Post, New Bradford, Mass.	McNally Construction Co., Fall River, Mass.
Addition to Coast Artillery Post, Portland, Me.	F. W. Cunningham & Sons, Portland, Me.
Addition to Coast Artillery Post, Charleston, S. C.	Gallivan Building Co., Greenville, S. C.
Cantonment for Engineer Troops, Belvoir, Va.	P. F. Gormley Co., Washington, D. C.
Philadelphia, Pa., General Depot	William Steele & Sons Co., Philadelphia, Pa.
Washington, D. C., Telephone Building	Frank L. Wagner, Washington, D. C.
Cantonment Buildings, Leon Springs Training Camp	Weston & Kroeger, San Antonio, Tex.
Cantonment, San Juan, Porto Rico	Purdy & Henderson Company, New York & Havana.
Tuberculosis Sanitarium, Otisville, N. Y.	R. H. Howes Construction Co., New York City.

Thirty Appointments to Navy's Civil Engineer Corps

Thirty candidates who passed a recent examination have been appointed to fill 10 vacancies and 20 temporary positions in the grade of assistant civil engineer, in the navy. The strength of the Corps of Civil Engineers, formerly composed of 30 civil engineers and 36 assistant civil engineers, is now increased to 96. The 233 candidates who took the preliminary examination represented 65 colleges, universities, and technical schools, coming from 37 states and from England, Canada, Russia, France, Switzerland, and the Territory of Hawaii. Of this number 80 passed the preliminary examination and were authorized to appear at Washington for the final. Out of the 73 reporting, 23 failed to qualify physically, leaving 50 to compete in the written examination.

Another Special Engineer Regiment To Be Organized

Another new engineering regiment for special service in France is now being recruited, and announcement has been made of a long list of men trained in various branches of engineering to make up the total of 1500 men which will be required. The regiment will be known as the 319th Engineers, and will be under the command of Lieut.-Col. C. L. Sturdevent. Maj. James A. Dorst is in charge of the recruiting at army headquarters in San Francisco. The regiment will be mobilized and prepared for service at Camp Fremont, Palo Alto, California.

While the list of trades in which skilled workers are desired includes practically every branch in any way identified with electrical, mechanical and civil engineering, among the largest numbers required are powder and demolition men, carpenters, surveyors, draftsmen, mine timber men, track workers, adzmen, etc. It is announced that the regiment will be recruited, equipped and trained with the greatest possible dispatch.

Big Concrete Telephone Exchange for War and Navy Departments

A large new reinforced-concrete telephone and telegraph building is now being erected for the use of the War and Navy Departments at 1723 F St., N.W., Washington. The entire structure, with its necessary equipment will be built in record-breaking time, it is believed.

The new telephone and telegraph establishment is planned as a three-story and basement building, fronting 44 ft. on F St. and running 114 ft. deep. It is to be of brick construction, the front and side returns of face brick with limestone cornice and belt courses.

Detroit Experiments To Aid Design of 250,000,000-Gal. Filters

The water commissioners of Detroit, Mich., have retained R. Winthrop Pratt, consulting engineer, Cleveland, Ohio, to make preliminary studies and investigations and to prepare outline plans for a filtration plant to treat the entire water-supply of the city. F. H. Stephenson will be associated with Mr. Pratt as principal assistant engineer. The studies will be made in coöperation with Theodore A. Leisen, general superintendent of water-works, and his chief assistant, H. B. Keeney. Mr. Leisen recently has been commissioned major in the U. S. Reserve Corps, and is in charge of utilities at Camp Custer. Alex. Dow, president of the Detroit Edison Co., is chairman of the committee of the board having the work in charge.

For some months past there has been in operation a test filter with a capacity of 200,000 gal. a day. Studies at this test plant will be continued as part of the work in order to obtain practical data relative to the maximum feasible rate of filtration and kind of coagulant best adapted to the local water.

General plans and estimates of the quantities necessary for the construction of a filtration plant having a capacity of at least 250,000,000 gal. per day will be prepared. Such a plant would be located in the immediate vicinity of the present water-works pumping station.

The action of the water commissioners does not mean that the city will necessarily proceed with the construction of the filtration plant. It is the purpose at this time to make in a very careful and thorough manner, justified by the size of the project, all necessary investigations, so that when construction prices again approach a more normal level, installation of the plant can be begun if desired.

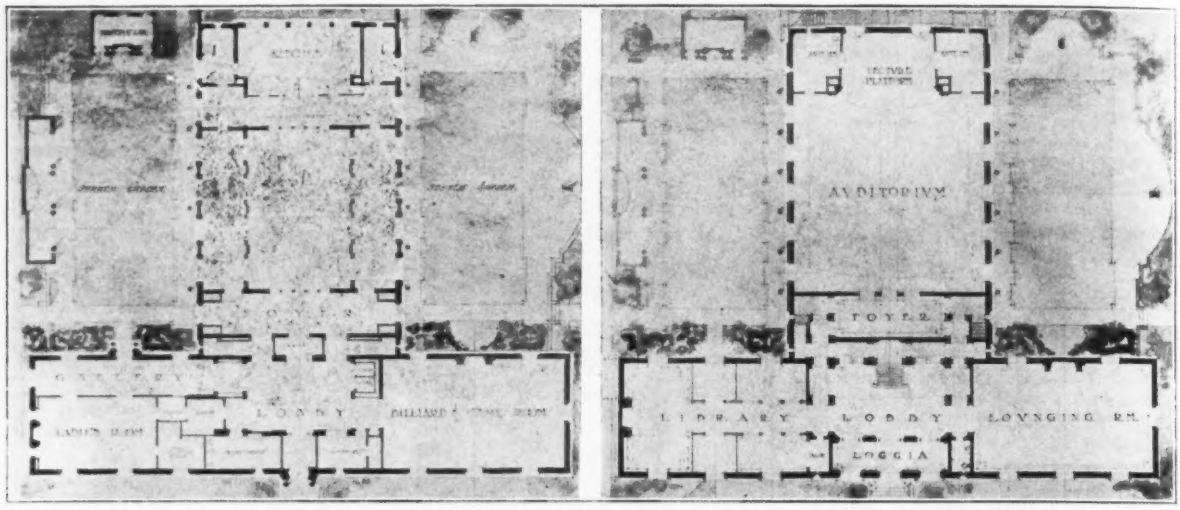
Engineers at Dayton, Ohio, Open New Club House

Dedication of the new building for the Engineers' Club of Dayton, Ohio, which will take place on Feb. 2, will be an important event for this active organization and for the engineering interests of the city and the district which it serves. The club has now about 300 members. Its rapid growth is due to its own activities and to the increased amount of engineering work that is now required by the industrial and manufacturing establishments of the city.

This growth has made it necessary to provide larger quarters, adequate not only for the meetings and the technical work of the organization, but also for the social features which are an important part of its activities.

The building is located at Monument Ave. and Jefferson St., fronting the river. It is three stories high, T-shaped in plan, 150 x 125 ft., with a sunken garden in the space on each side of the stem. An entrance lobby occupies the middle portion of the head of the T, with a broad stairway to the second floor. At the right of the lobby is the secretary's office, and beyond this is the billiard room. At the left of the lobby are a visiting gallery, ladies' reception room, and checking and toilet rooms. In the stem is the main dining room, flanked by private rooms on each side, and beyond this is the kitchen.

In the central part of the second floor is a large lobby at the head of the stairway. This is flanked on one side by the library and reading room, from which open two library alcoves and two conference rooms, all fitted with bookcases for more than 10,000 volumes. At the other side of the lobby, directly over the billiard room, is a lounging room, 30 x 50 ft. In the stem of the building is the auditorium or lecture hall, which can seat about 450 persons. Four fireproof stairways lead from this room to the ground. On the third floor are bedrooms with bath and toilet facilities, and a locker room for the convenience of members who live at a distance from the club.



FIRST- AND SECOND-FLOOR PLAN OF NEW HOME FOR ENGINEERS' CLUB, OF DAYTON

Bedford limestone and gray-buff brick are used for the exterior, the brick being laid with wide joints in white mortar. Fireproof construction is used throughout. The steam heating plant is operated in connection with a ventilating system designed to change the air in each room from three to six times per hour.

Schenck & Williams, of Dayton, are the architects. Col. E. A. Deeds, chief of the Aircraft Production Board, is president of the club; the vice-presidents are C. F. Kettering, of the Dayton Metal Products Co., Orville Wright and Henry M. Waite, city manager of Dayton. F. O. Clements is treasurer; H. I. Schenck, recording secretary, and W. E. Bingham, house secretary.

The building and grounds are the gift of Colonel Deeds and Mr. Kettering.

Expenses Paid to North Carolina Road Institute

The state laws in North Carolina provide that the County Road Commission may delegate any or all persons employed by it to attend the annual session of the State Road Institute, which is held annually at the University of North Carolina. In addition, the law provides that all such expenses may be paid legally out of the funds of the said county, township or road district. This year the institute is to be held Feb. 19 to 22.

Tacoma To Erect Dwellings for Workers

Owing to shipbuilding activities at Tacoma, Wash., and the location of the Army cantonment at American Lake, the housing problem in Tacoma has become acute. One real estate dealer announced that he would build 600 bungalows, starting work immediately. Mayor Fawcett has issued an appeal to other patriotic citizens to respond to Tacoma's need in a similar manner.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN RAILWAY ENGINEERING ASSOCIATION; 910 Michigan Ave., Chicago; Mar. 20-22, Chicago.

AMERICAN INSTITUTE OF MINING ENGINEERS, 29 West 39th St., New York; Feb. 18-21, New York.

At the quarterly meeting of the **Nothwestern Society of Highway Engineers**, held recently in Portland, Ore., Herbert C. Nunn, state highway engineer of Oregon, was elected president. The other officers elected were: vice-president, Prof. G. V. Skelton; treasurer, J. J. Brooks; secretary, C. G. Reiter. Dr. E. W. Lazell, O. Laurgaard and Prof. F. H. Graff were elected directors.

The Engineers' Club of Memphis, Tenn., on Jan. 9 elected the following officers: A. L. Dabney, president; C. C. Pashby, vice-president; C. L. Ford, secretary-treasurer; Thomas L. LaMalta, E. H. Bowser, and W. S. Myrick, directors, J. H. Weatherford was chosen for past president for another year.

The meting of the **Oregon Societies of Engineers**, Jan. 23, at Portland, was addressed by William L. Finley, state biologist, who spoke on "The Rambles of a Naturalist," and other subjects.

The annual meeting of the **Minnesota Surveyors' and Engineers' Society** will be held in Duluth, Feb. 21-23. Headquarters will be at the Duluth Commercial Club. John Wilson, consulting engineer, Duluth, is president.

At a joint meeting of the **Detroit Engineering Society** and the **Detroit Section, American Society of Mechanical Engineers**, Jan. 25, G. A. Mattsson, H. W. Miller and George B. Turnbull, all of the Great Lakes Engineering Works, presented papers on "Lake Freighters" and "Standard Government Boats for War Work."

The Technology Club, of Kansas City, Mo., met on Jan. 24 and listened to an address by Prof. C. Frank Allen, for many years instructor in railroad engineering at the Massachusetts Institute of Technology.

The Associated Engineering Societies of St. Louis, at their annual dinner Jan. 23 entertained Arthur N. Talbot, the recently elected president of the American Society of Civil Engineers; Brig. Gen. William H. Bixby, president of the American Society for Testing Materials; Col. Cunliffe Murray, Commanding Officer, Jefferson Barracks, and Frank C. Reilly, freight traffic manager, St. Louis-San Francisco Railway Company.

The Engineers' Club of Springfield, Ill., partook of its annual banquet Jan. 15. It was followed by the annual meeting of the club and the election of the following officers for the present year: President, H. B. Lewis; vice president, John Leisenring; secretary, J. I. Hughes; treasurer, C. A. Crytser.

At a regular meeting of the **Society of Terminal Engineers**, held in New York City Jan. 22, there was a discussion of the West Side New York terminal situation as evolving under war conditions. Calvin Tomkins, former dock commissioner of the City of New York, was the principal speaker.

The regular annual meeting of the **Engineers' Societies of Northwestern Pennsylvania** was held in Erie, Jan. 16. The election of the following officers for 1918 was announced: President, R. C. Stevens; first vice president, Armin Schotte; second vice president, F. S. Newhard; secretary, M. C. Emanuel; treasurer, W. H. Reynolds; director for two-year term, C. H. Schum. Announcement was made that the Erie section of the American Institute of Electrical Engineers would hold a joint meeting with the Engineers' Society on Feb. 12, and would provide as the principal speaker of the evening D. B. Rushmore, chief engineer of the power and mining division of the General Electric Company.

The annual meeting and banquet of the **Binghamton N. Y. Engineering Society** was held Jan. 21. The following officers were elected for the ensuing year: Past President and Chairman of Executive Committee, Robt. B. Hoadley; President, C. A. Dayton; First Vice-President, C. E. Anderson; Second Vice-president, Charles Van Amburgh; Third Vice-president, Burt E. Nelson; Secretary, D. M. Edgerton; Treasurer, F. A. Tillman; Librarian, Ray Fitzpatrick.

There was a conference of delegates from all the engineering societies in Ohio at Brown Hall, Ohio State University, Columbus, Jan. 29. The annual meeting of the **Ohio Engineering Society** will be held in the Deshler Hotel, Columbus, Jan. 30-Feb. 1.

The annual convention of the **Montana Institute of Municipal Engineers** was held at Bozeman, Mont., Jan. 21-23. Among the topics discussed were the relation of the war to the municipal engineers of Montana; street cleaning and garbage disposal, sewers and sewage disposal, standardization of specifications, highways and pavements, water systems and purification plants, etc. On Jan. 22 a visit was paid to the Montana State College at Bozeman.

The Florida Engineering Society held its annual meeting at Jacksonville, Jan. 7. R. E. Chandler, professsor in the mechanical engineering department of the University of Florida, was elected president; George B. Hills, engineering manager of the Isham Randolph Co., Jacksonville, vice president, and Prof. J. R. Benton, dean of the engineering school at the University of Florida, secretary. C. S. Hammatt and H. D. Martin, of Jacksonville, were elected to the directorate. The convention listened to the reading and discussion of various papers on technical topics.

At the annual meeting of the **Civil Engineers' Society of St. Paul**, Jan. 14, the following officers were elected: President, A. F. Meyer; vice president, E. S. Spencer; secretary, P. C. Gauger; treasurer, E. O. Korsmo; editor-in-chief, C. H. Stewart; representative on the Minnesota Joint Engineering Board, three-year term, George H. Herrold.

The following nominations for officers of the **American Water-Works Association** for 1918-19 have been made: For president, Charles R. Henderson, manager, Water Co., Davenport, Iowa; for vice president, Carleton E. Davis, chief, Bureau of Water, Philadelphia, Penn.; for treasurer, James M. Caird, bacteriologist, 271 River St., Troy, N. Y.; for trustees, Jack J. Hinman, Jr., bacteriologist, State Board of Health, Iowa City, Iowa, and Allan W. Cuddeback, engineer and superintendent, Passaic Water Co., Paterson, N. J. The time for filing additional nominations closes this year Feb. 13. All petitions for additional nominations must be in the hands of the secretary, J. M. Diven, 47 State St., Troy, N. Y., on or before that date to secure a place on the official ballot.

The Richmond Engineers' Club and the Richmond Section of the American Chemical Society, Richmond, Va., held a joint meeting Jan. 18. Allen J. Saville, of Richmond, delivered an address on some of the problems of camp construction. Mr. Saville was engaged in the laying out and supervising of the construction of Camp Lee, near Petersburg, Virginia.

Members of the Pittsburgh Chapter of the American Association of Engineers, at their monthly business meeting Jan. 14, elected the following officers for the coming year: P. B. Waldin, chairman; E. E. Bankson, chairman of membership committee; R. C. Corson, secretary, and H. C. McCormick, treasurer.

The Engineers' Society of Milwaukee (which is the Milwaukee section of all national engineering societies) held a meeting Jan. 16, at which Walter Alexander, superintendent of motive power of the Chicago, Milwaukee &

St. Paul Railway Co., delivered an illustrated lecture on "Electric Locomotives on the Chicago, Milwaukee & St. Paul Railway."

At the meeting of the recently organized Society of **Russian-American Engineers** that was held Jan. 29 in the Assembly Rooms of the Merchants' Association of New York, Woolworth Building, New York City, Dr. J. A. L. Waddell spoke on "Comparative Design of Bridges in Russia and the United States."

The Cleveland Association of Members of the American Society of Civil Engineers has elected the following officers: Harry Fuller, president; A. J. Himes, vice-president, and G. H. Tinker, secretary and treasurer. The association has indorsed the resolution adopted by the Board of Direction of the society on Nov. 1, urging congress to amend sections 200 and 209 of the War Tax Law, which exact double taxation from certain professional men.

The Engineers' Club of Dayton, Ohio, held its regular monthly meeting Jan. 8, the speaker of the evening being J. M. Schoonmaker, Jr., chief engineer of the Dayton-Wright Airplane Co. His subject was "Airplane Surfaces," and included an analytical presentation of all phases of the design of such surfaces.

At the regular meeting Jan. 19, of the **Colorado Association of Members of the American Society of Civil Engineers,** held in Denver, the speaker was L. B. Skinner, vice-president and general manager of the Western Chemical & Mfg. Co., Denver. His subject was "The Manufacture of Military Explosives."

At the meeting of the **Detroit Engineering Society,** Jan. 18, Capt. J. W. Inches, M.D., health officer of Detroit, addressed the society on the subject "With the Engineers on the Italian Battlefront." Capt. Inches was sent to Europe with Bishop Williams and others in the interest of the American Red Cross. He was one of five Detroiters who were forced to retreat with the Italian army during the Austrian drive, and at one place they were but a few hours ahead of the enemy. The talk was illustrated by slides from pictures taken abroad.

The Albany Society of Civil Engineers held its regular meeting Jan. 22, and listened to an address by a member, Enrique Touceda, consulting chemist, who spoke on "Some Metallurgical Facts of Interest to Engineers." The address was illustrated.

The Technology Club of Syracuse, N. Y., the local engineering society, will be addressed Feb. 4 by Dr. J. A. L. Waddell, who will speak on "The Engineering Profession Fifty Years Hence." Other speakers scheduled for the winter meetings are Prof. V. Karapetoff, of Cornell, Prof. Charles R. Mann, of the Massachusetts Institute of Technology, and George T. Hammond, engineer of design, Bureau of Sewers, Brooklyn.

A conference of the engineering, irrigation, agricultural and live stock societies of Idaho was held at Idaho Falls, Jan. 14 to 19. Among the societies represented were the **Idaho Society of Engineers,** the **Idaho Irrigation Congress** and the **Good Roads Association.** The congress discussed road construction, irrigation, flood control, city planning, sewer construction and other public questions.

At the January meeting of the **Providence Engineering Society,** Providence, R. I., Albert Cook Church delivered an illustrated lecture on the development of the submarine. On Jan. 23 the municipal engineering section of the society listened to an address by H. Anthony Dyer, on "The Development of the Metropolitan Park System."

PERSONAL NOTES

C.-E. A. WINSLOW, professor of public health, Yale Medical School, New Haven, Conn., received a presentation medal on Jan. 18 from the National Institute of Social Science, in recognition of his work in promoting the study of public health. Before assuming his full professorship at Yale in 1915, Professor Winslow was successively assistant professor of sanitary biology at the Massachusetts Institute of Technology, associate professor of bacteriology at the University of Chicago and of biology at the College of the City of New York. While at the Institute he was (1903-10) biologist-in-charge of the sanitary research laboratory, where he conducted extensive studies of sewage treatment. Since 1910 he has been Curator of Public Health, American Museum of Natural History. In 1914-15 he was Director of the Division of Public Health Education, New York State Department of Health. He is a member of the Public Health Council of the State of Connecticut and is now conducting an extensive investigation on the purification of the sewage of New Haven. During the summer of 1917 he was a member of the American Red Cross mission to Russia. Interesting notes on what he saw and learned in Russia fill about thirty pages of "Public Health Reports" for Dec. 28, 1917 (Washington, D. C.) under the title, "Public Health Administration in Russia in 1917."

Besides books on bacteriology and microscopy and numerous contributions to engineering, medical and other scientific journals and society proceedings, Professor Winslow was joint author of "Sewage Disposal" (1910) with Prof. L. P. Kinnicutt and R. W. Pratt.

J. DAVIS, director general of public works of the Province of New South Wales, Australia, is making a tour of the Western United States in quest of information desired by his province in connection with the construction of irrigation work contemplated there. Particular attention has been given to the Roosevelt Dam and the system it supplies. Before returning to Australia, Mr. Davis is to call upon Washington officials in connection with the question of equipment for Australian railways.

CHARLES BOONE has been appointed city engineer of Greenfield, Ind., for the ensuing four years. Mr. Boone is at present serving his second year as surveyor and county engineer of Hancock County, Indiana. After leaving Purdue University he was employed in Iowa for about three years before his election to the office of surveyor and county engineer of Hancock County.

BERTRAND H. WAIT has entered the employ of the Portland Cement Association and on Feb. 1 will take up his duties with the association as district engineer in charge of the Portland Cement Association's New York office, 101 Park Ave. Mr. Wait was graduated from Cornell University in 1902 with the degree of civil engineer. In 1913 he became division engineer, New York State Highway Department in charge of Division No. 1, which consisted of ten counties adjoining New York City. During the past year Mr. Wait has also served as consulting engineer for the United States Government on cantonment road construction.

SAMUEL FRAZER LUSK, who was until recently a superintendent of construction for the Flynt Building and Construction Co., Palmer, Mass., has been commissioned a first lieutenant in the U. S. Army.

J. L. MORY, contracting engineer, Chico, Calif., has enlisted in the 20th Engineers.

C. S. BENNETT has resigned his position as resident engineer and inspector, Department of Public Roads of Kentucky, to accept a position with the Miami Conservancy District, Dayton, Ohio.

HARRY REINHARDT, who has been elected engineer of Shamokin Borough, Penn., has resigned as a member of the Susquehanna Coal Co.'s engineering corps, with which he had been associated for 11 years.

C. M. ADAMS has been appointed city engineer of Bellingham, Wash., and A. C. Blake has been made water superintendent of the city.

H. O. CARSON was elected city engineer of Butler, Penn., which recently changed its form of government from that of a borough to that of a third-class city.

JOHN H. RYCKMAN, formerly of Toronto, is now with the Algoma Construction and Engineering Co., Sault Ste. Marie, Ont. For the past 4½ years he has been engaged with the

Toronto Department of Works on the $2,500,000 Bloor St. viaduct, at first on the designing staff and later as field engineer.

ELMER O. PENNY has resigned as water commissioner of Charleston, Mo., and has been succeeded by S. F. SHELL.

BENJAMIN A. HALDEMAN has resigned his position as engineer to the zoning commission of Philadelphia. He also had charge of the plans of the survey bureau of the city. Mr. Haldeman was in the city's employ for 24 years and developed the Parkway, the South Broad St. Boulevard, the zoning system and other important municipal improvements.

EDWARD OSCAR HEINRICH has been appointed city manager of Boulder, Colo. Mr. Heinrich, who goes to Boulder from Alameda, Calif., will assume his duties Feb. 15.

N. F. THOMPSON, district engineer of the New York Central R.R. at Albany, has been transferred to Buffalo as district engineer, succeeding F. E. PARADIS, resigned. He is succeeded at Albany by B. C. MARTIN, who also remains district engineer of the Hudson River Connecting Railroad.

A. M. YOUNG, Seattle, Wash., has been appointed consulting engineer and representative in Seattle of the Concrete Piling Co., of Seward, Nebraska.

FRED MCPHERSON, formerly municipal engineer of Nelson, B. C., who has been provisional district engineer, with headquarters at Nelson, for the past year, has been promoted to a position in the office of the provincial government engineer at Victoria.

GEORGE A. RICKER, formerly district engineer of the Portland Cement Association at Kansas City, and more recently located at the Chicago headquarters, has been made district manager at Washington. Mr. Ricker was formerly first deputy commissioner in the New York State Highway Department.

H. P. HOEY, assistant chief engineer of the Southern Pacific Railway Co., who has been in charge of the building of the Coos Bay branch of the road, with headquarters at Eugene, Ore., has been transferred to San Francisco. The construction offices which the company has maintained for the past five years in Eugene have been closed.

F. W. EPPS, until recently in the bridge department, Kansas City Terminal Co., at Kansas City, Mo., is now bridge engineer for the Kansas State Highway Commission, Topeka, Kansas.

ADAM THOMAS SHURICK, who was a member of the editorial staff of *Coal Age*, New York, has been promoted from the rank of first lieutenant to that of captain in the Engineer Reserve Corps.

The following former captains in the Engineer Reserve Corps have been promoted to the rank of major: JAMES E. CASSIDY, JOHN H. HOUSE, JR., FREDERICK W. ALBERT, JAMES P. LEAF, JAMES W. OGIER, GEORGE E. A. FAIRLEY, WILLIAM L. LAW, SYDNEY L. SMITH, LOUIS E. ROBBE, CLARENCE T. STARR, GEORGE BLOW, HENRY W. DURHAM, JOHN F. TRUMBULL, JOSEPH CACCAVAJO, EDWARD M. GRAVES and HENRY L. MCMILLAN.

PAUL S. JONES, formerly assistant irrigation engineer in the U. S. Department of Agriculture, has been appointed junior civil engineer in connection with the flood-control projects of the Sacramento and San Joaquin rivers, California, under the War Department.

ROGER F. HILL, chief engineer of the Andrew J. Smith Construction Co., Detroit, has been commissioned a first lieutenant in the Ordnance Department. ALBERT E. WARDWELL, formerly Mr. Hill's assistant, has succeeded him.

EDWIN F. WENDT, member of the Engineering Board, Interstate Commerce Commission, and past president of the American Railway Engineering Association, has been elected president of the Washington, D. C., Society of Engineers.

OBITUARY

SIR JOHN WOLFE WOLFE-BARRY, prominent British engineer, member of the Army Railway Council, and past president of the Institution of Civil Engineers, died in London, Jan. 22. He was born Dec. 7, 1836, and was educated at Trinity College, Glenalmond, and King's College, London. For many years he was associated with the design and construction of great engineering works in Great Britain, Ireland, India and China. He became president of the Institution of Civil Engineers June, 1896, and in 1897 was created by Queen Victoria a Knight Commander of the Bath. He was the engineer on the Tower bridge across the Thames at London, the Blackfriars railway arch bridge, the Barry dock and railways, the Kew bridge, the Surrey commercial dock and other important works. Among his written works were "Railway Appliances," "Lectures on Railways and Locomotives," and "The Tower Bridge."

SECOND LIEUT. GORDON D. COOKE, Corps of Engineers, U. S. Army, died at the base hospital at Fort Bliss, Texas, on Jan. 10. Lieutenant Cooke was graduated from the University of Michigan in 1916, and was a member of the editorial staff of *Engineering Record* early in 1917. Later he entered the service of another department of the McGraw-Hill Co., and made his headquarters at his home city, Detroit. On Sept. 1, 1917, at the age of twenty-four, he received a commission as second lieutenant in the Engineer Corps. He was temporarily stationed in a remote section of New Mexico, 75 miles from a railroad, and was engaged in the making of military maps for the U. S. Geological Survey, when he contracted pneumonia.

LIEUT. LEONARD M. BLUMENFELD, of the United States Engineers, formerly assistant engineer of Caddo parish, Louisiana, died Jan. 11, at Camp Beauregard. Lieutenant Blumenfeld was among the first young men to leave Shreveport, La., in response to the Government's call for candidates for officers. He attended the first officers' school at Camp Pike, and upon graduation was commissioned as first lieutenant. After receiving his commission he was stationed at Fort Leavenworth, Kan., and later at Camp Pike in road construction work, and then at Camp Beauregard in the same kind of work. His home was at Opelika, Alabama.

SIR WILLIAM H. LINDLEY died at Putney, England, on Dec. 30, at the age of 65. He was the son of William Lindley, the engineer who reconstructed the water, gas and sewer systems of Hamburg, Germany, after the great fire of 1842. The son was resident engineer for his father on the Budapest water-works, 1870-73, after which for 22 years he was chief engineer of Frankfort-on-Main, Germany, during which period he built water, sewage and harbor works for the city. During his career he was consulting engineer for various continental cities and designed works for supplying Petrograd with water from Lake Ladoga. He was a member of the commission on the regulation of the Danube at Vienna and president of the engineering standards committee of the German Gas and Water-Works Engineers. He was knighted for services on the British Royal Commission on Canals and Waterways.

FRANK M. WAKEFIELD, Syracuse, N. Y., engineer in the City Water Bureau for the past thirty years, died Jan. 15. He was 63 years old.

JACOB BIERSUCK, structural and hydraulic designer with the Southern Power Co., Charlotte, N. C., died Jan. 15 at the age of 27. Before his connection with the Southern Power Co. Mr. Biersuck was assistant engineer with the Public Service Commission, First District, New York City, and later with the City Transit Department of Philadelphia. He was a graduate of Cornell University, class of 1913.

INDUSTRIAL NEWS AND COMMENT

ABOUT MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Rail Embargo Ties Up Philadelphia Plants

Served Only by Lines Affected, Equipment Makers There Have Difficulties—Special Permits Issued

Just as Eastern industries started their wheels turning after the five-days' fuel shutdown a new railroad embargo was decreed at Washington, which barred all freight except fuel, food and war supplies from the Pennsylvania R.R. east of Pittsburgh, the Baltimore & Ohio east of the Ohio River and all of the lines of the Philadelphia & Reading.

The definition of "war supplies" was left to the various Government departments in Washington. Railroads, through their local agents, simply refused freight which did not clearly come under the exempt classifications, unless the manufacturer obtained a special Government order.

Philadelphia Hard Hit

Philadelphia, served entirely by the three railroads named in the embargo, felt the greatest force of the new ruling. Some manufacturers, who had been shipping under priority orders, were confused by it. Much of their output, going directly to shipyards and to plants engaged on Navy work, was declined by the railroads' local agents and protests to higher officials brought no relief.

The larger industries which hold direct contracts for Government work are endeavoring to obtain exemptions for their sub-contractors.

War Shipments Held Up

R. D. Wood & Co., of Philadelphia, manufacturers of hydraulic machinery, has shipments valued at $150,000 in its plant which cannot be moved because of the embargo. Much of this will go to the Bethlehem Steel Co. and to companies which have important contracts for the Navy Department.

David Lupton's Sons, of Philadelphia, makers of steel sash and roof trusses, were permitted to resume operations under the fuel-shutdown order Tuesday, but cannot now ship their products in any direction. According to David P. Forstner, general manager, there are 40 carloads of finished products in the shop awaiting shipment.

"Everything we are making in this plant is Government work," said Mr. Forstner. "Much of this material is for the shipyard and for Government buildings. We have been unable to obtain permission to ship any of this material."

Departments Give Exemptions

The American Engineering Co., of Philadelphia, builders of stokers and marine-engine equipment, was granted full exemption from the fuel order after the plant had been closed one day. Shipments are hampered, however, by the railroad embargo order.

"All of our output is needed by the Government," said M. Alpern, manager of this firm. "Seventy-five to 80% of it is going directly to Government departments and most of the remainder is for industries vital to the war.

"We have to obtain permission to make each class of shipment from the Government department directly interested in it. On our Navy work the Navy Department orders its shipments moved, the Shipping Board gives us permission to move its particular work, and the railroads accept the orders of each of these and other Government branches. We have shipped practically no stokers during the last ten days, excepting part carloads representing repairs and parts. So far as full carload shipments of stokers are concerned—we cannot make them.

"We employ 1800 men in our two plants in Philadelphia and have four plants under contract to us, employing 2000 men. These plants were obliged to close down by the recent fuel order. Coal is now coming in and we do not anticipate further fuel difficulties."

Fuel Shipments Diverted

The Link-Belt Co., maker of coal-handling conveying machinery, is badly cramped for yard room and will soon feel the effect of the railroad embargo, according to S. B. Peck, its acting president. This company has plants in Chicago, Indianapolis and Philadelphia. It employs more than 4000 men. All plants were reduced to 20% output during the fuel-shutdown period.

"Coming so closely after the fuel-closing order," said Mr. Peck, "the embargo creates a most serious fuel problem for us. So far we have been able to keep all of our plants supplied with fuel, but the State Fuel Administrators have diverted our shipments under instructions of the general Fuel Administration.

"We have exemption on about 20% of our present output, which is for a very pressing need of the Government. We have a great deal of other Government work—probably 75% of our total output, but we were so far ahead with this that we were told to close down on it.

"There are ample stocks of pig iron and steel in our plants, so that even a week's embargo will not hamper us on these materials. The worst phase of the embargo for us is the haste with which it was put into effect. This left us without opportunity to prepare for it. Relief in the coal situation is not apparent."

New York and other cities are not so seriously affected by the railroad embargo order, being served by other railroads besides the three affected on which the embargo applied.

One New York manufacturer who was "exempt" from fuel closing was unable to ship castings from his foundry to the machine shop as these would have to be carried over the tracks of an "embargoed" railroad.

Stagnation Reported in Detroit Industries

Bad Weather Retards Recovery from the Coal Shutdown Order—Fuel Shortage Keeps Plants Closed

Detroit, Mich., Jan. 28—Neither Detroit industrial plants nor domestic consumers of coal appear to have benefited from the five days of stagnation imposed by the order of the Federal fuel administration. Domestic coal reserves were not augmented, the traffic situation was not materially improved and a number of factories that closed Jan. 18 were unable to reopen Jan. 23 because of lack of coal. Unfavorable weather conditions, perhaps, were in part responsible for failure of the order to obtain the results expected. The assertion is made that some of the workers forced out of closed plants found employment in the few establishments which were permitted to operate. The extent of this loss of men to unexempted factories would be difficult to determine.

Many Industries Close

More than 30 manufacturing plants in the Boydell Power buildings have been forced to suspend. The American Car and Foundry Co. has closed its forge department to permit operating the foundry department a few days longer. The company has large war contracts.

With a 10-day supply of coal the Detroit Edison Co., sole source of Detroit's commercial lighting and power, is obliged to draw on its reserve daily. The Solvay Process Co., using 90 cars daily, received 185 in five days. The company provides part of Detroit's gas supply. Fuel administrators in Ohio and Kentucky were reported to be confiscating coal ordered to Michigan, which would cut off the supply of numerous industries, including some working on war orders.

The Michigan Steel Castings Co., the Roe-Stephens Manufacturing Co. and the Flower-Stephens Manufacturing Co. are a few among many large Detroit industrial plants that faced immediate suspension. There were scores in a similar dilemma, with no relief in prospect. In Grand Rapids, Mich., many manufacturing establishments were reported closed. Except for a few turning out munitions, all Kalamazoo industrial plants were closed. The Consumers' Power Co. of that city is getting no coal and faces a shutdown. In Albion, the Commonwealth Power Co. cut off power and all factories were idle.

Conditions in practically all other towns of the state may be described as similar. Conditions seem to be worse than before the fuel-administration order was sent out.

Echoes of the Shutdown

Most of the manufacturers in the New York district started up without mishap.

The Barber Asphalt Co. plant at Maurer, N. J., which shut down for the five-day period, paid its entire force for the full time. As a result, every man was on the job bright and early Wednesday morning, and the plant production went ahead at full blast.

Crucible Steel at Harrison, N. J. (near Newark), was closed the first day of the period but was later exempted. The plant was running at regular capacity by Tuesday.

Driver-Harris Co., also at Harrison, N. J., makers of electrical wire, kept its foundry working by permission of the Government. The men all returned to work.

At the Lambert Hoisting Engine Co. the period of the shutdown was utilized to check stock. The plant was entirely shut down so far as any use of fuel was concerned. No men were lost by the plant during the shutdown, which saved this company 16 tons of coal.

Davis-Bournonville Co., Jersey City, N. J., makers of oxyacetylene welding and cutting equipment, has a warehouse full of equipment intended for the Government. Although it closed for the complete five-day period, the entire force of employees returned to work.

Construction Industries May Be Denied Power

The Public Service Electric Co., which supplies power to a number of big manufacturers of construction equipment in northern New Jersey, has issued warning that it may have to shut down on account of lack of coal. At the time of the warning the company only had four days' supply of coal on hand, with no relief in sight.

The company has put its consumers on "rations," supplying power on Monday, Wednesday and Friday to Newark and its vicinity and on the remaining days of the week delivering power to Hoboken and Jersey City.

Highway Industries Organize To Aid Nation's Traffic

Engineers, Contractors and Manufacturers Combine To Promote Efficient Wartime Service

Representatives of two billion dollars invested in industries vitally interested in the country's highways met in Chicago Jan. 21 to complete the organization of the Highway Industries Association. The all-inclusive character of this new association is indicated by the fact that the 125 men present represented not only engineers, contractors and county, state and Federal highway officials, but also such important industries as the manufactures of cement, brick, sand, gravel, stone, slag, bituminous materials, road machinery, rubber tires, motor trucks and motor cars and accessories.

As noted by S. M. Williams in the opening address, the purpose of the organization is to devise ways and means for united coöperation with all Governmental agencies, state and national: First, in the coördination of the highways with other transportation agencies; second, in encouraging the development of highways that will advance the economic life of the nation, and third, in stimulating their use in such manner as to facilitate and cheapen the transportation of food, raw materials and finished product, to the end that the highways may be of maximum service in the carrying system of the country.

In the constitution adopted, four classes of membership are provided, organization, company, associate and subscribing. Annual dues are to be $100 for each class, except that associates will not be required to pay dues. Organization members are defined as national associations composed of companies, firms or individuals whose business interests embrace the construction or use of highways. The use of the term "associates" for others is self-explanatory. The officers elected are as follows: President, S. M. Williams, Garford Motor Truck Co.; vice presidents, A. R. Hirst, state highway engineer, Wisconsin; Lion Gardiner, *Engineering News-Record;* and S. T. Henry, Allied Construction Machinery Corporation. The secretary is to be a paid officer, elected by a board of directors, which will be made up of the above officers and one director elected by the association's holding memberships, and one director for each 50 company memberships.

S. E. Bradt, state superintendent of highways, Illinois, and representing the American Association of State Highway Officials, indicated how the organization could be of assistance in educating the public and officials away from their present attitude of procrastination in road construction until prices have fallen. In his opinion, roads cost less than two years ago, when the prices of other commodities are taken into consideration. But promiscuous road building must give way to trunk lines connecting centers of production. Car service and labor are two most important factors impeding work in Illinois. Money to the extent of $5,000,000 or $6,000,000 is available.

"A real opportunity exists to prove to official Washington that good roads are a vital necessity," said Lion Gardiner, "because this association is not organized for the promotion of any special interest. The association should help materially in getting data for the Highway Transport Committee Questionnaire."

James T. Voshell, U. S. Office of Public Roads, said that the country is waking up to the fact that roads are no longer a local problem. Five through routes in Illinois, four in Indiana, four in Kentucky and four in Michigan have been selected for Federal aid.

George C. Diehl, consulting engineer, Buffalo, representing the American Automobile Association, called special attention to the loss that will be entailed when roads under construction or repair must be closed. Detours as for railroad traffic should be carefully planned in advance.

Of almost startling significance are the strides the Post Office Department is making in rural parcel post motor-truck service. James I. Blakeslee, fourth assistant postmaster, told of the rapid increase in routes which are being established in the Eastern States. These routes are usually about 125 miles long and reach into food production areas not easily accessible to the markets of New York, Philadelphia, Baltimore and other Eastern cities. By rail a dozen eggs from Vineland, N. J., must be handled 14 times by the ordinary parcel post before they reach the consumer in Philadelphia. By the new motor-truck service this number is cut to six. On Dec. 15, motor-truck service was established between Oxford, Penn., and Baltimore. It is 110 miles and the truck has been late 20 min. on its 5-hour schedule just once. In 30 days it has earned at the rate of $9000 a year and has been run one-quarter full one way. The expense of operation is estimated at $4200 annually. After two weeks' operation perishable farm produce was offered but had to be refused on account of freezing. Within three days the truck company had installed heaters and Mr. Blakeslee states that in summer the truck will be cooled.

It is the aim of the department to reach out 25 to 150 miles beyond the team-haul area around large centers of population and to put on the trucks now so that the producer will have visual evidence of the service and plant crops this spring. An ambitious system of trunk lines between New York and New Orleans by way of Chicago has been laid out, with numerous feeder routes, and Mr. Blakeslee is optimistic that the postage will be far in excess of the cost of operation.

In his opinion, some of the problems

this association should attack, are the completion of necessary links in present inter-city routes, a standardized truck so that the department can buy it anywhere, and support for an enabling motor-truck service act.

B. F. Affleck, president of the Universal Portland Cement Co., called attention to the fact that his company lost many thousands of dollars, as no doubt many others lost, by the failure of transportation during the past year, and roads were the only outlet avenue.

W. P. Blair, sceretary of the National Paving Brick Manufacturers' Association, was of the opinion that inadequate transportation is one of the greatest hindrances to the prosecution of the war. The provision of additional facilities, such as roads offered, is, therefore, a paramount consideration.

Bringing the Big Guns of Industry To Bear Upon Germany

Shall a trade embargo be levied against Germany after the war by the industries and commercial men of America, unless the German Government is made responsible to the German people?

A referendum embodying this question is being voted upon now by half a million members of the Chamber of Commerce of the United States. It is submitted to the various commercial organizations of the country in the form of the following resolution:

"Whereas, the size of Germany's present armament and her militaristic attitude have been due to the fact that her government is a military autocracy, not responsible to the German people; and

"Whereas, the size of the German armament after the war will be the measure of the greatness of the armament forced on all nations, and

"Whereas, careful analysis of economic conditions shows that the size of Germany's future armament will fundamentally depend on her after-war receipts of raw materials and profits from her foreign trade; and

"Whereas, in our opinion the American people for the purpose of preventing an excessive armament will assuredly enter an economic combination against Germany if governmental conditions in Germany make it necessary for self-defense; and

"Whereas, we believe the American people will not join in discrimination against German goods after the war if the danger of excessive armament has been removed by the fact that the German government has in reality become a responsible instrument controlled by the German people; therefore, be it

"Resolved, that the Chamber of Commerce of the United States of America earnestly calls the attention of the business men of Germany to these conditions and urges them also to study this situation and to coöperate to the end that a disastrous economic war may be averted and that a lasting peace may be made more certain."

This referendum was suggested by the Boston Chamber of Commerce. In case it is adopted by the members of the national chamber it is hoped to communicate its result to German business men through international chambers of commerce. German business men who are now visiting Switzerland, Holland, Denmark, Sweden and other neutral countries will also be asked to carry the message from industrial America.

Government To Control Bond Issues

Securities Issued by Corporations, States and Counties Now Regulated

Investment of capital will be regulated by the Government as a war measure. The Federal Reserve Board, through a Capital Issues Committee, will control the placing of all securities in a volume of $500,000 or above, in the case of industrial and public-utility corporations, and $250,000 in the case of states, counties and municipalities.

The membership of the Capital Issues Committee is as follows: Paul M. Warburg, Charles S. Hamlin and Frederick A. Delano, member of the Federal Reserve Board, with an advisory committee consisting of Allen B. Forbes, senior partner of the firm of Harris, Forbes & Co., of New York; F. H. Goff, president of the Cleveland Trust Co., of Cleveland, Ohio, and Henry C. Flower, president of the Fidelity Trust Co., of Kansas City, Missouri.

It is the intention of the committee to pass upon all bond issues for public improvements aggregating in cost the figures mentioned. All public improvements will be scrutinized as to their value from the standpoint of military necessity.

Notes of the Industries

One hundred and seventy-three exhibitors have reserved space in the tenth annual exhibition of the National Railway Appliances Association, to be held at the Coliseum, Chicago, Mar. 18-21, inclusive.

The Vulcan Steel Products Co.'s representative in Paris, George S. Thompson, was recently appointed to the purchasing board of the American Expeditionary Forces in France. He has been assigned particularly to the handling of steel matters. This board is composed of American civilians living in France, headed by Major Drake, and their duties consist of passing upon all purchases made in Europe by the American Army. Among the other members on the committee are representatives of Armour & Co., Baldwin Locomotive Works, Standard Steel Car Co., American International Corporation, Vacuum Oil Co., United States Steel Products Co., Borgfelt & Co., Allied Machinery Co., and the United States Rubber Company.

An exhibition of 1000 trade and technical journals opened Jan. 13 at the Newark Library Art Gallery, Newark, New Jersey.

At the annual meeting of the National Lime Manufacturers' Association, to be held in Chicago, Feb. 6-7, the subject of coördinating the different bureaus of the Association under one head will come up for action. William E. Carson announces that he will retire from the presidential chair after 10 years' active service as head of the Association.

Milton Rupert was recently elected vice-president and assistant treasurer of the R. D. Nuttall Co., Pittsburgh, Penn., manufacturers of gears, pinions, and trolleys. Mr. Rupert has been with the Nuttall Co. since Mar. 4, 1893, holding various positions. In 1903 he was appointed head of the general offices, being directly in touch with all office matters and also manufacturing operations. During the latter part of this period Mr. Rupert was assistant to the president and general manager. In his new position Mr. Rupert will have charge of sales and manufacturing activities.

Russell T. Gray, formerly advertising manager of the Haynes Automobile Co., and more recently secretary of the Shuman Advertising Co., has opened an office in the First National Bank Building, Chicago, as an advertising engineer. Technical advertising in trade papers and magazines, as well as all forms of engineering catalogs and direct-by-mail advertising will be handled.

The Alexander Milburn Co., Baltimore, manufacturer of Milburn portable acetylene lights, has opened a Chicago office at 1012 Kimball Building. S. B. Moats, formerly with the Municipal Engineering and Contracting Co., will have charge of this new branch, serving all of Wisconsin, Illinois and Indiana, as well as parts of Iowa, Missouri, Ohio, Minnesota and Kentucky. The company is establishing agencies in this territory.

Edward McKim Hagar Dead

Edward McKim Hagar, president of the American International Steel Corporation, a subsidiary of the American International Corporation, died suddenly Jan. 17 at his home in New York. Mr. Hagar became president of the company in June last year. He was formerly president of the Universal Portland Cement Co. and of the Wright-Martin Aeroplane Company.

C. C. Williams Killed in Collision

Charle C. Williams, president of the G. H. Williams Co., Erie, Penn., was killed in a collision between his automobile and an interurban trolley car at Erie, on Jan. 20. The accident occurred within half a mile of the point where Mr. Williams' father, G. H. Williams, was killed in a similar manner two years ago.